EXHIBIT 1

US005803834A

United States Patent [19]

Yamagishi et al.

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[54] **TWO-PIECE SOLID GOLF BALL**

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[73] Assignee: **Bridgestone Sports Co., Ltd.**, Tokyo, Japan

[21] Appl. No.: **810,337**

[22] Filed: **Feb. 27, 1997**

[30] **Foreign Application Priority Data**

Mar. 1, 1996 [JP] Japan 8-071135

[51] **Int. Cl.**^{6} **A63B 37/06**; A63B 37/12

[52] **U.S. Cl.** **473/377**; 473/372; 473/378

[58] **Field of Search** 473/377, 351, 473/383, 384

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[57] **ABSTRACT**

In a two-piece solid golf ball comprising a solid core and a cover having a number of dimples, the solid core has such a distribution of hardness on a JIS-C hardness scale that a surface hardness is 70–85 degrees and a center hardness is lower than the surface hardness by 8–20 degrees, and the hardness within 5 mm inside the core surface is up to 8 degrees lower than the surface hardness. The cover has a hardness of 75–90 degrees on a JIS-C hardness scale which is higher than the surface hardness of the core by 1–15 degrees and a gage of 1.5–1.95 mm. The number of dimples is 360–450. Since the hardness distribution of the core and cover, the gage of the cover, and the number of dimples are optimized, the ball is improved in flight distance, controllability and hitting feel.

4 Claims, 2 Drawing Sheets

FIG.1

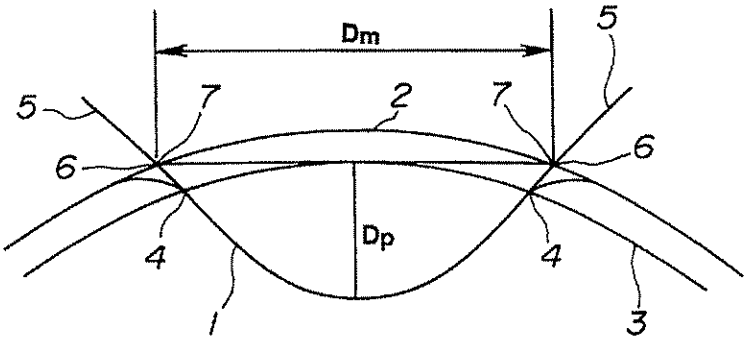


FIG.2

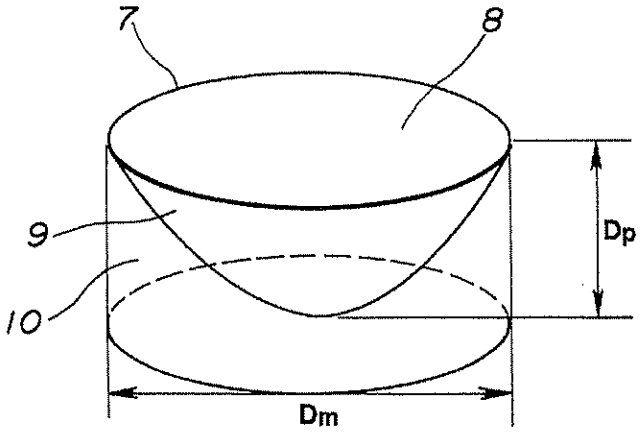
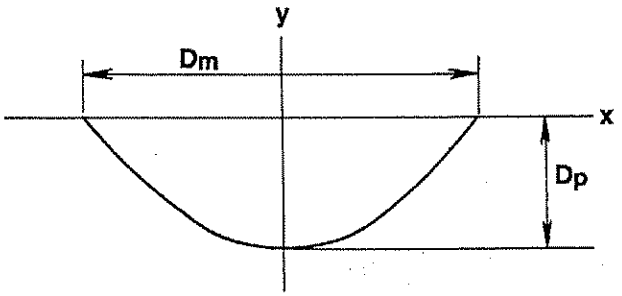


FIG.3



TWO-PIECE SOLID GOLF BALL

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a two-piece solid golf ball which is improved in flying distance, controllability, and hitting feel.

2. Prior Art

In order to manufacture golf balls of quality, numerous proposals for improving a flight distance, controllability and hitting feel have been made in the art. With respect to two-piece solid golf balls, many attempts have been made to improve performance by optimizing the hardness and hardness distribution of solid cores and covers as disclosed in JP-B 48832/1991 and 98206/1994, JP-A 109971/1992, 98949/1994, 154357/1994, 327792/1994, and 289661/1995.

Golf players always demand a golf ball which is further improved in flight distance, controllability and hitting feel. The same applies to two-piece solid golf balls.

SUMMARY OF THE INVENTION

An object of the invention is to provide a two-piece solid golf ball which is improved in flight distance, controllability and hitting feel.

According to the invention, there is provided a two-piece solid golf ball comprising a solid core and a cover enclosing the core and having a number of dimples in its surface. The solid core has such a distribution of hardness as measured by a JIS-C scale hardness meter that a surface hardness is up to 85 degrees, a center hardness is lower than the surface hardness by not less than 8 degrees to less than 20 degrees, and a hardness within 5 mm inside the core surface is up to 8 degrees lower than the surface hardness. The cover has a hardness which is higher than the surface hardness of the core by 1 to 15 degrees and a gage of 1.5 to 1.95 mm. The number of dimples is 360 to 450.

In one preferred embodiment, the solid core experiences a distortion of 2.8 to 4.0 mm under a load of 100 kg.

In a further preferred embodiment, n types of dimples are formed in the cover surface wherein n≧2. The respective types of dimples have a diameter Dmk, a maximum depth Dpk, and a number Nk wherein k=1, 2, 3, . . . , n. An index (Dst) of overall dimple surface area given by the following expression:

$$Dst = \frac{\sum_{k=1}^{n} [(Dmk^2 + Dpk^2) \times V_0 k \times Nk]}{4R^2}$$

wherein R is a ball radius and V_0 is the volume of a dimple space below a plane circumscribed by the edge of a dimple divided by the volume of a cylinder whose bottom is the plane and whose height is the maximum depth of the dimple from the bottom is at least 4.0. Preferably the cover has a hardness of 75 to 90 degrees as measured by a JIS-C scale hardness meter.

Investigating the flying distance, restitution, controllability, and feel of a two-piece solid golf ball, we have found the following.

When a ball undergoes a greater amount of deformation upon impact as found on driver shots, the deformation of the ball reaches a core center region. In such deformation mechanism, the cover, core surface region and core center region closely participate in deformation while the degree of participation decreases in this order. More particularly, the core surface makes a great contribution to deformation. At the same time, a difference in hardness between the core surface and the cover makes a great contribution to deformation to such an extent as to govern restitution or repulsion. A too large hardness difference leads to a larger energy loss, failing to provide sufficient restitution to travel a satisfactory distance.

If the distribution of hardness from the center to the surface through a surface-adjoining region of the core is relatively flat and at a higher level, the energy loss in the surface-adjoining region of the core mostly participating in deformation is small enough to provide restitution, but the hitting feel is hard due to the hardness near the center. Inversely, if the hardness distribution is relatively flat and at a lower level, there result a greater energy loss, insufficient restitution, and soft hitting feel. If the difference in hardness between the core surface and the cover is too large, then the hitting feel is soft, but dull at the same time.

With a focus on the surface and surface-adjoining region of the core, if the difference in hardness between the surface and the surface-adjoining region (within 5 mm from the surface) of the core is too large, the energy associated with deformation is not fully retained. This results in a greater energy loss, failing to maintain sufficient restitution.

By optimizing the hardness distribution of the core and the hardness difference between the core and the cover, we have succeeded in providing a two-piece solid golf ball which features satisfactory restitution, an acceptable flying distance, soft hitting feel, good spin properties on iron shots, and ease of control.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic cross-sectional view of a dimple illustrating how to calculate V_0.

FIG. 2 is a perspective view of the same dimple.

FIG. 3 is a cross-sectional view of the same dimple.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention pertains to a two-piece solid golf ball comprising a solid core and a cover. The 2-piece solid golf ball of the invention requires that the hardness distribution of the core be optimized. When the solid core is measured for hardness by a JIS-C scale hardness meter, the core has a hardness on its spherical surface (to be referred to as surface hardness, hereinafter), a hardness at a position located within 5 mm from the surface in a radial direction, and a hardness at the center (to be referred to as center hardness, hereinafter). The solid core should have such a distribution of hardness that the surface hardness is up to 85 degrees, preferably 70 to 83 degrees, the center hardness is lower than the surface hardness by not less than 8 to less than 20 degrees, preferably not less than 10 to less than 17 degrees, and the hardness within 5 mm inside the core surface is up to 8 degrees, preferably up to 5 degrees, lower than the surface hardness.

If the surface hardness of the core exceeds 85 degrees, the hitting feel becomes unpleasant. If the surface hardness is too low, restitution would be lost.

The center hardness is lower than the surface hardness, that is, the core center is softer than the core surface. If the hardness difference therebetween is less than 8 degrees, which means that the hardness distribution among the center, surface and surface-adjoining region of the core is relatively flat, the energy loss in the surface-adjoining region of the core mostly participating in deformation is small enough to provide restitution. However, the hitting feel is hard if the core center is hard. Inversely, if the core center is soft, the energy loss becomes too large to provide restitution and the hitting feel is soft. If the hardness difference is 20 degrees or more, restitution is lost.

While the above-mentioned hardness difference is maintained, the center hardness of the core should preferably be 50 to 75 degrees, more preferably 55 to 70 degrees on a JIS-C hardness scale for improvements in restitution, control and feel.

The hardness within 5 mm inside the core surface (that is, the hardness of a region of the core which radially extends from the surface to a depth of 5 mm in cross section) is lower than the surface hardness by 8 degrees or less, preferably by 5 degrees or less. If the hardness difference between the surface and the surface-adjoining region (within 5 mm from the surface) of the core is too large, then the energy associated with deformation is not fully retained, resulting in a greater energy loss and failure to maintain restitution.

A solid core having the above-defined hardness distribution may be formed from a conventional well-known composition comprising a base rubber, a crosslinking agent, a co-crosslinking agent, and an inert filler while vulcanizing conditions and formulation are appropriately adjusted so as to meet the requirements of the invention.

The base rubber used herein may be natural rubber and/or synthetic rubber conventionally used in solid golf balls although 1,4-polybutadiene having at least 40% of cis-structure is especially preferred in the invention. The polybutadiene may be blended with a suitable amount of natural rubber, polyisoprene rubber, styrene-butadiene rubber or the like if desired. The crosslinking agent is typically selected from organic peroxides such as dicumyl peroxide and 1,1-bis(t-butylperoxy)-3,3,5-trimethylcyclohexane. Preferred is a mixture of 1,1-bis(t-butylperoxy)-3,3,5-trimethylcyclohexane and dicumyl peroxide, especially in a blend ratio of 0.1:1 to 0.5:1. The co-crosslinking agent is typically selected from metal salts of unsaturated fatty acids, inter alia, zinc and magnesium salts of unsaturated fatty acids having 3 to 8 carbon atoms (e.g., acrylic acid and methacrylic acid) though not limited thereto. Zinc acrylate is especially preferred. The amount of the co-crosslinking agent blended is preferably about 10 to 40 parts by weight, more preferably about 20 to 30 parts by weight per 100 parts by weight of the base rubber. Examples of the inert filler include zinc oxide, barium sulfate, silica, calcium carbonate, and zinc carbonate, with zinc oxide being often used. The amount of the filler blended is preferably about 5 to 20 parts by weight, more preferably about 8 to 15 parts by weight per 100 parts by weight of the base rubber although the amount largely varies with the specific gravity of the core and cover, the weight of the ball, and other factors.

A core-forming composition is prepared by kneading the above-mentioned components in a conventional mixer such as a Banbury mixer and roll mill, and it is compression or injection molded in a core mold. The molding is then cured by heating at a sufficient temperature for the crosslinking agent and co-crosslinking agent to function (for example, at 160° C. for 20 minutes), obtaining a solid core.

A core having a desired hardness distribution can be produced by appropriately determining the formulation, especially the type and amount of crosslinking and co-crosslinking agents and vulcanizing conditions.

The solid core should preferably have a distortion of 2.8 to 4.0 mm, especially 3.0 to 3.8 mm under a load of 100 kg. Then the ball is further improved in restitution, control and hitting feel. A distortion of less than 2.8 mm would give a poor hitting feel whereas a distortion of more than 4.0 mm would fail to provide restitution.

Although the diameter, weight and specific gravity are not critical, the solid core preferably has a diameter of 37 to 41 mm, especially 38 to 41 mm and a weight of 30 to 37 grams, especially 31 to 36.5 grams.

Next, the cover enclosing the solid core should have a hardness which is higher than the surface hardness of the core by 1 to 15 degrees, preferably by 2 to 5 degrees, as measured on JIS-C hardness scale. If the difference in hardness between the core surface and the cover is less than 1 degree, the ball loses some restitution and thus travels a shorter distance. If the hardness difference is more than 15 degrees, the hitting feel becomes dull. Insofar as the hardness difference is satisfied, the cover hardness is not critical. Preferably the cover has a hardness of 75 to 90 degrees, especially 77 to 86 degrees as measured by a JIS-C scale hardness meter. A cover hardness of less than 75 degrees would lead to less restitution whereas a cover hardness of more than 90 degrees would render the hitting feel dull.

The cover has a gage (radial thickness) of 1.5 to 1.95 mm, preferably 1.55 to 1.90 mm. A cover with a gage of less than 1.5 mm would be low in cut resistance upon half-top hitting whereas a cover of more than 1.95 mm thick would lead to low restitution and dull hitting feel.

The cover satisfying such requirements may be formed of any well-known cover stock, typically based on a thermoplastic resin. Exemplary thermoplastic resins are thermoplastic urethane elastomers, ionomer resins, polyester elastomers, polyamide elastomers, propylene-butadiene copolymers, 1,2-polybutadiene, and styrene-butadiene copolymers alone or in admixture of two or more. Various additives such as barium sulfate, titanium oxide, and magnesium stearate may be added to the thermoplastic resin.

The cover may be formed by conventional methods, for example, by injection molding or compression molding a cover stock around the solid core.

Like conventional golf balls, the solid golf ball of the invention is formed with a multiplicity of dimples in the surface. The number of dimples is 360 to 450, preferably 370 to 420.

Furthermore, the golf ball of the invention wherein the number of types of dimples formed in the ball surface is n wherein n is an integer of at least 2, preferably n=2 to 6, more preferably n=3 to 5, and the respective types of dimples have a diameter Dmk, a maximum depth Dpk, and a number Nk wherein k=1, 2, 3, . . . , n prefers that an index Dst of overall dimple surface area given by the following equation is at least 4.0, more preferably at least 4.2.

$$Dst = \frac{n \sum_{k=1}^{n} [(Dmk^2 + Dpk^2) \times V_0 k \times Nk]}{4R^2}$$

Note that R is a ball radius, V_0 is the volume of a dimple space below a plane circumscribed by the edge of a dimple divided by the volume of a cylinder whose bottom is the plane and whose height is the maximum depth of the dimple from the bottom.

Referring to FIGS. 1 to 3, it is described how to determine V_0. For simplicity's sake, it is assumed that the planar shape of a dimple is circular. As shown in FIG. 1, a phantom sphere 2 having the ball diameter and another phantom sphere 3 having a diameter smaller by 0.16 mm than the ball diameter are drawn in conjunction with a dimple 1. The circumference of the other sphere 3 intersects with the dimple 1 at a point 4. A tangent 5 at intersection 4 intersects with the phantom sphere 2 at a point 6 while a series of intersections 6 define a dimple edge 7. The dimple edge 7 is so defined for the reason that otherwise, the exact position of the dimple edge cannot be determined because the actual edge of the dimple 1 is rounded. The dimple edge 7 circumscribes a plane 8 (having a diameter Dm). Then as shown in FIGS. 2 and 3, the dimple space 9 located below the plane 8 has a volume Vp. A cylinder 10 whose bottom is the plane 8 and whose height is the maximum depth Dp of the dimple from the bottom or circular plane 8 has a volume Vq. The ratio V_0

of the dimple space volume Vp to the cylinder volume Vq is calculated.

$$Vp = \int_0^{\frac{Dm}{2}} 2\pi xy dx$$

$$Vq = \frac{\pi Dm^2 Dp}{4}$$

$$V_0 = \frac{Vp}{Vq}$$

It is noted that the value of V_0 is generally 0.40 to 0.60, preferably 0.41 to 0.58 though not critical.

The two-piece solid golf ball of the invention may be produced in accordance with the Rules of Golf to a diameter of at least 42.67 mm and a weight of up to 45.93 grams.

There has been described a two-piece solid golf ball in which the hardness distribution of the core and cover, the gage of the cover, and the number of dimples are optimized to achieve improvements in flight distance, controllability and hitting feel.

EXAMPLE

Examples of the present invention are given below by way of illustration and not by way of limitation. All parts are by weight.

Examples 1–3 & Comparative Examples 1–4

By milling a solid core-forming rubber composition formulated as shown in Table 1 and vulcanizing it under conditions as shown in Table 1, there was prepared a solid core having an outer diameter, a hardness distribution and a distortion under a load of 100 kg as reported in Table 4. Note that hardness was measured by a JIS-C scale hardness meter.

Next, a cover stock formulated as shown in Table 2 was milled and injection molded over the solid core to form a cover, obtaining a 2-piece solid golf ball. At the same time as injection molding, dimples were formed in the cover surface in a combination as shown in Table 3. The resulting golf ball had a weight and an outer diameter as shown in Table 4.

The golf balls were examined for controllability, hitting feel and flight distance. Three professional golfers examined controllability and hitting feel by an actual hitting test. The flight distance (carry and total distance) was determined by actually hitting a ball by means of a swing robot at a head speed of 45 m/s.

Control

It was examined whether a ball was controlled as intended on iron shots (ease of hooking and slicing) and whether a ball stops short on the green. With respect to these two factors, the ball was totally evaluated. Ratings are "◎" for satisfactory, "O" for ordinary, and "X" for poor.

Hitting feel

A ball was actually hit with No. 1 wood and No. 5 iron to judge whether it was felt soft or hard. Dullness was evaluated in terms of subtle reaction upon hitting. The hard/soft feel was rated "◎" for a soft feel, "O" for ordinary, and "X" for a hard feel. The dull feel was rated "◎" for a click feel, "O" for ordinary, and "X" for a dull feel.

TABLE 1

		Core						
		E1	E2	E3	CE1	CE2	CE3	CE4
Composition	Cis-1,4-polybutadiene	100	100	100	100	100	100	100
	Zinc acrylate	26	23	30	20	35	30	23
	Zinc oxide	22	23	20	25	19	20	23
	Dicumyl peroxide	1	1	1	1	1	1	1
	Peroxide*	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Vulcanizing conditions	Temperature (°C.)	160	160	160	120	120	160	160
	Time (min.)	20	20	20	80	80	20	20
Distortion under 100 kg (mm)		3.4	3.8	2.9	4.1	2.0	2.9	3.8

*1,1-bis(t-butylperoxy)-3,3,5-trimethylcyclohexane (trade name: Perhexa 3M-40, Nihon Fats and Oils K.K.)

TABLE 2

		Cover			
		A	B	C	D
Composition	Himilan 1557	50	—	50	—
	Himilan 1601	50	—	—	—
	Himilan 1605	—	—	50	50
	Himilan 1855	—	50	—	—
	Himilan 1856	—	50	—	—
	Himilan 1706	—	—	—	50
Hardness, JIS-C		83	81	86	93

Himilan is the trade name of ionomer resin commercially available from Mitsui-duPont Polychemical K.K.

TABLE 3

	Dimple				
Set	Dm (mm)	Dp (mm)	V_0	Number	Dst
I	4.000	0.210	0.500	72	
	3.850	0.200	0.500	200	
	3.400	0.180	0.500	120	
				total 392	4.540
II	3.800	0.210	0.480	162	
	3.600	0.210	0.480	86	
	3.450	0.210	0.480	162	
				total 410	4.265
III	3.300	0.195	0.390	360	
	2.500	0.195	0.390	140	
				total 500	2.060

Dm: dimple diameter, Dp: dimple depth, Number: number of dimples, V_0 and Dst: as defined above.

TABLE 4

			Golf ball						
			E1	E2	E3	CE1	CE2	CE3	CE4
Core	Outer diameter (mm)		38.9	38.9	39.3	38.9	38.9	39.3	38.9
	Hardness (JIS-C)	Center	60	57	65	60	80	65	57
		5 mm from the surface	73	69	77	63	83	77	69
		Surface	77	76	80	65	85	80	76
	Distortion under 100 kg (mm)		3.4	3.8	2.9	4.1	2.0	2.9	3.8
Cover	Type		B	B	A	A	C	D	B
	Hardness (JIS-C)		81	81	83	83	86	93	81
Ball	Outer diameter (mm)		42.7	42.7	42.7	42.7	42.7	42.7	42.7
	Weight (g)		45.3	45.3	45.3	45.3	45.3	45.3	45.3
Dimple set			I	II	I	I	II	I	III
Performance	Controllability		◎	◎	◎	◎	○	X	○
	Hard/soft feel		◎	◎	◎	◎	X	○	◎
	Dull feel		◎	◎	◎	X	○	X	◎
	Carry (m)		215.3	215.0	215.8	208.5	213.5	214.0	211.6
	Total (m)		232.6	232.0	233.0	228.0	231.0	231.5	227.5

Japanese Patent Application No. 71135/1996 is incorporated herein by reference.

Although some preferred embodiments have been described, many modifications and variations may be made thereto in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

We claim:

1. A two-piece solid golf ball comprising a solid core and a cover enclosing the core and having a number of dimples in its surface, wherein

said solid core has such a distribution of hardness as measured by a JIS-C scale hardness meter that a surface hardness is up to 85 degrees, a center hardness is lower than the surface hardness by not less than 8 to less than 20 degrees, and a hardness within 5 mm inside the core surface is up to 8 degrees lower than the surface hardness,

said cover has a hardness which is higher than the surface hardness of the core by 1 to 15 degrees and a gage of 1.5 to 1.95 mm, and

the number of dimples is 360 to 450.

2. The two-piece solid golf ball of claim 1 wherein said solid core experiences a distortion of 2.8 to 4.0 mm under a load of 100 kg.

3. The two-piece solid golf ball of claim 1 wherein n types of dimples are formed in the cover surface wherein $n \geqq 2$, the respective types of dimples having a diameter Dmk, a maximum depth Dpk, and a number Nk wherein k=1, 2, 3, . . . , n, and

an index (Dst) of overall dimple surface area given by the following expression:

$$Dst = \frac{n \sum_{k=1}^{n} [(Dmk^2 + Dpk^2) \times V_0 k \times Nk]}{4R^2}$$

wherein R is a ball radius and V_0 is the volume of a dimple space below a plane circumscribed by the edge of a dimple divided by the volume of a cylinder whose bottom is the plane and whose height is the maximum depth of the dimple from the bottom is at least 4.0.

4. The two-piece solid golf ball of claim 1 wherein said cover has a hardness of 75 to 90 degrees as measured by a JIS-C scale hardness meter.

* * * * *

EXHIBIT 2

THIS EXHIBIT HAS BEEN REDACTED IN ITS ENTIRETY

EXHIBIT 3

IN UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

BRIDGESTONE SPORTS CO., LTD., AND BRIDGESTONE GOLF, INC., ***Plaintiffs,*** *v.* **ACUSHNET COMPANY,** ***Defendant.***	C.A. No. 05-132 (JJF)

JOINT CLAIM CONSTRUCTION STATEMENT

Plaintiffs Bridgestone Sports Co., Ltd., and Bridgestone Golf, Inc. ("Bridgestone") and Defendant Acushnet Company ("Acushnet") hereby submit this joint claim construction statement.

I. Bridgestone Patent US 5,252,652

The parties agree as to the following definition:

Cl	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"having an improved rebound property and initial velocity"	Plain and Ordinary Meaning	

The parties disagree on the following definitions:

Cl	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"a base rubber selected from the group consisting of polybutadiene rubber, natural rubber, polyisoprene rubber, and styrene-butadiene rubber"	Plain and Ordinary Meaning	The use of "consisting of" in this claim means that one and only one base rubber selected from the group of polybutadiene rubber natural rubber, polyisoprene rubber, and styrene-butadiene rubber.

Bridgestone submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 5,252,652: Col. 1, lines 44-47; Col. 1, lines 58-60; Col. 2, lines 15-21; Col. 2, lines 22-36; Col. 3, lines 25-31; Col. 3, line 55 to Col. 5, line 2, including Examples and Tables; Col. 5, lines 7-11; Claims 1-13.

In the file history of US Patent 5,252,652: Application, p. 2, lines 10-13; Application, p. 2, lines 23-25; Application, p. 3, lines 11-31; Application, p. 6, line 10 – p. 8, line 25, including Examples; Application, pp. 9-10; Dec. 12, 1990 Office Action, pp. 2-4; April 12, 1991 Declaration of Egashira, pp. 1-3; April 12, 1991 Amendment, pp. 4-9; July 8, 1991 Office Action, pp. 2, 3; Oct. 8, 1991 Amendment, pp. 2-6; Dec. 11, 1991 Office Action, pp. 2, 3; Apr. 13, 1992 Declaration of Egashira, pp. 2, 3; Apr. 13, 1992 Amendment, pp. 1-7; May 5, 1992 Office Action, pp. 2, 3; Aug. 5, 1992 Declaration of Egashira, pp. 2, 3; Aug. 5, 1992 Response, pp. 1-6; Oct. 13, 1992 Office Action, pp. 2, 3; Mar. 12, 1993 Amendment, pp. 2-10; April 9, 1993 Notice of Allowability, p. 2.

Acushnet submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 5,252,652: Col. 2, lines 22-36; Tables 1-2 (Col. 4); Col. 5, lines 6-11.

In the file history of US Patent 5,252,652: Application, p. 3, lines 18-31; Application, p. 7, Table 1; Application, p. 8, Table 2; Application, p. 9, claims 1, 2; Dec. 12, 1990 Office Action, pp. 2-3; Declaration of Egashira, pp. 2-3; April 12, 1991 Amendment, pp. 1-2, 4-5, 6; Aug. 7, 1991 Office Action, pp. 2-3.

Cl.	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"about"	Approximately, in the stylistic and technological context in which it is used.	Approximately, as would be understood by those skilled in the art to mean the precision with which the quantity the term is used to modify can be measured.

Bridgestone submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 5,252,652: Col. 2, lines 48-51; Col. 2, line 65 to Col. 3, line 2; Col. 3, lines 11-14; Col. 3, lines 17-19; Col. 3, line 55 to Col. 5, line 2, including Examples and Tables; Col. 5, lines 10-20; Claims 1-13.

In the file history of US Patent 5,252,652: Application, p. 4, lines 6-10; Application, p. 4, lines 23-28; Application, p. 5, lines 1-4; Application, p. 5, lines 7-8; Application, p. 6, line 10 – p. 8, line 25, including Examples; Application p. 9; Dec. 12, 1990 Office Action, pp. 2-4; April 12, 1991 Declaration of Egashira, pp. 1-3; April 12, 1991 Amendment, pp. 4-9; July 8, 1991 Office Action, pp. 2, 3; Oct. 8, 1991 Amendment, pp. 2-6; Dec. 11, 1991 Office Action, pp. 2, 3; Apr. 13, 1992 Declaration of Egashira, pp. 2, 3; Apr. 13, 1992 Amendment, pp. 1-7; May 5, 1992 Office Action, pp. 2, 3; Aug. 5, 1992 Declaration of Egashira, pp. 2, 3; Aug. 5, 1992 Response, pp. 1-6; Oct. 13, 1992 Office Action, pp. 2, 3; Mar. 12, 1993 Amendment, pp. 2-10; April 9, 1993 Notice of Allowability, p. 2.

Acushnet submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 5,252,652: Col. 2, lines 48-51, Col. 2, line 66-Col. 3, line 2; Col. 3, lines 11-14, 17-19, 30-31; Tables 1-2 (Col. 4); Col. 5, lines 11, 13, 19, Col. 6, lines 19-21.

In the file history of US Patent 5,252,652: Application, p. 4, lines 6-10, 24-28;

Application, p. 5, lines 1-4, 7-8; Application, p. 7, Table 1; Application, p. 8, Table 2; Application, p. 9, claims 1, 2; Dec. 12, 1990 Office Action, pp. 2-3; March 25, 1991 Declaration of Egashira, pp. 2-3; April 12, 1991 Amendment, pp. 1, 2, 5, 6; July 8, 1991 Office Action, pp. 2 - 3; Dec. 11, 1991 Office Action, pp. 2-3; Apr. 6, 1992 Declaration of Egashira, pp. 2-3; Aug. 5, 1992 Response, pp. 4-5; U.S. Patent No. 4,770,422 ("Composition for Making Durable Golf Balls and Other Products"): Abstract; Col. 2, lines 3-16; Col. 3, lines 42-48; U.S. Patent No. 4,556,220 ("Solid Golf Balls"): Col. 2, lines 8-14; U.S. Patent No. 4,129,538 ("Peptizing Agent for Natural Rubber and Synthetic Butadiene-Styrene Rubber"): Col. 3, lines 18-22.

II. Bridgestone Patent US 5,553,852

The parties agree as to the following definition:

Cl	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"center core"	An object forming a center of a golf ball	

The parties disagree on the following definitions:

Cl	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"a thickness of at least 1 mm"	Plain and Ordinary Meaning	A thickness that is no less than 1.0 mm.

Bridgestone submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 5,553,852: Abstract, lines 4-6; Col. 2, lines 13-15; Col. 2, lines 32-35; Col. 3, lines 28-33; Col. 3, lines 46-47; Table 2, Examples 1-6 and Comparative Examples 1-3; Col. 7, lines 3-4; Col. 7, lines 3, 4; Claims 1-8.

In the file history of US Patent 5,553,852: Application, p. 4, lines 21-22; Application, p. 5, lines 20-22; Application, p. 8, line 24 – p. 9, line 6; Application, p. 9, lines 23-25; p. 16, Table 2, Examples 1-6 and Comparative Examples 1-3; Application, pp. 18-19; Application, p. 20, line 7-8; May 18, 1995 Office Action; p. 2; Dec. 7, 1995 Amendment, pp. 5-14; Sept. 26, 1995

Declaration of Yamagishi, pp. 2-7.

Acushnet submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 5,553,852: Abstract; Col. 1, lines 6-10; Col. 1, line 65 - Col. 2, line 2; Col. 2, lines 7-10; Col. 2, lines 13-14, 33-34, 55-56, 59-61; Col. 3, lines 29-30, 33-34, 46-49; Table 2; Col. 6, line 65-Col. 7, line 10.

In the file history of US Patent 5,553,852: Application, p. 4, lines 2-7, 13-20; Application, p. 5, lines 20-22; Application, p. 6, lines 19-21; Application, p. 6, line 25- p. 7, line 2; Application, p. 8, line 24- p. 9, line 1; Application, p. 9, lines 5-6; Application, p. 9, line 23- Application, p. 10, line 2; Application, p. 18, lines 3-17; Application, p. 20, lines 7-8, Oct. 18, 1995 Amendment, p. 6; U.S. Patent No. 5,253,871 ("Golf Ball"): Col. 3, lines 3-4; Col. 4, lines 1-3; Tables 1, 3; Col. 7, lines 5-8.

Cl.	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"a thickness of 1 to 3 mm"	Plain and Ordinary Meaning	A thickness that is no less than 1.0 mm and is no greater than 3.0 mm.

Bridgestone submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 5,553,852: Abstract, lines 7-8; Col. 2, lines 18-20; Col. 2, line 35; Col. 3, lines 59-62; Table 2, Examples 1-6 and Comparative Examples 1-3; Col. 7, lines 8-9; Col. 7, lines 8-9; Claims 1-8.

In the file history of US Patent 5,553,852: Application, p. 5, lines 3-4; Application, p. 5, lines 23-24; Application, p. 10, lines 15-19; p. 16, Table 2, Examples 1-6 and Comparative Examples 1-3; Application, pp. 18-19; Application, p. 20, line 10-11; May 18, 1995 Office Action; p. 2; Dec. 7, 1995 Amendment, pp. 5-14; Sept. 26, 1995 Declaration of Yamagishi, pp. 2-7.

Acushnet submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 5,553,852: Abstract, Col. 1, lines 6-10; Col. 1, line 65-Col. 2, line 2; Col. 2, lines 7-10; Col. 2, lines 19-21, 36, 55-56; Col. 3, lines 59-61; Table 2; Col. 6, line 65-Col. 7, line 10.

In the file history of US Patent 5,553,852: Application, p. 4, lines 2-7, 13-22; Application, p. 5, lines 3-6, 23-24; Application, p. 6, lines 19-21; Application, p. 10, lines 15-19; Application, p. 18, lines 3-17; Application, p. 20, lines 10-11; Oct. 18, 1995 Amendment, pp. 6; GB 2 228 874 A ("Three-piece solid golf ball"): page 6, lines 21-22; Table 1 (page 10); GB 2 232 162 A ("Three piece solid golf ball"): page 6, lines 18-19; page 7, lines 15-19, 21-24; page 10 (Table 1); page 14, lines 32-34; GB 2 185 890 A ("Golf Ball"): page 2, lines 58-62; U.S. Patent No. 5,253,871 ("Golf Ball"): Col. 3, lines 3-4; Col. 4, lines 1-3; Tables 1, 3; Col. 7, lines 5-8; U.S. Patent No. 5,048,838 ("Three-Piece Solid Golf Ball"): Col. 1, lines 46-47; Col. 2, lines 41-45; Col. 3, lines 60-61; Table 1; Col. 6, lines 28-29; U.S. Patent No. 4,781,383 ("Solid Three-Piece Golf Ball"): Col. 4, lines 40-41; U.S. Patent No. 4,714,253 ("Three-Piece Solid Golf Ball"): Col. 3, lines 21-23; Table 1; Col. 6, lines 30-31; U.S. Patent No. 5,184,828 ("Solid Three Piece Golf Ball"): Col. 6, lines 31-34; Table 1.

III. Bridgestone Patent US 6,634,961

The parties agree as to the following definitions:

Cl.	Claim Term	Bridgestone's Definition	Acushnet's Definition
2	"The diene rubber (b) includes 30 to 100 wt % of a second polybutadiene"	Plain and ordinary meaning.	
1	"an organosulfur compound"	Plain and ordinary meaning.	

The parties disagree on the following definitions:

Cl	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"having a viscosity η at 25°C as a 5 wt % solution in toluene of up to 600 mPa·s"	Plain and ordinary meaning.	Having a viscosity η of 600 milli Pascal seconds or less. The viscosity being defined by the specification of the '961 patent to be measured "in mPa·s units" and being "obtained by dissolving 2.28g of the polybutadiene to be measured in 50 ml of toluene and carrying out measurement with a specified viscometer at 25°C using a standard solution for the viscometer (JIS Z8809)"

Bridgestone submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 6,634,961: Abstract; Col. 2, lines 17-39; Col. 2, lines 46-47; Col. 2, lines 58-65; Col. 3, lines 5-23; Col. 10, line 38 to Col. 14, line 8, including Examples and Tables; Col. 14, lines 15, 16; Claims 1-9.

In the file history of US Patent 6,634,961: Application, p. 3, line 20 – p. 4, line 6; Application, p. 4, lines 13, 14; Application, p. 4, line 23-30; Application, p. 5, lines 1-18; Application p. 18, line 1 to p. 22, line 12, including Examples and Tables; Application, pp. 23-24; Application, p. 25, lines 1-18; Sept. 10, 2002 Office Action, pp. 2-8; Feb. 10, 2003 Amendment, pp. 4-6.

Acushnet submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 6,634,961: Col. 2, lines 24-26; 44-48; 60-65; Col. 3, lines 5-24; Col. 6, lines 61-67; Col. 7, lines 1-8; Col. 11 (Table 1); Col. 14, line 9-Col. 15, line 21.

In the file history of US Patent 6,634,961: Application, p. 5, lines 1-18; Application, p. 23, line 3- p. 24, line 6; Feb. 10, 2003 Amendment pp. 1-2, 5, 8.

Cl.	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"base rubber composed of (a) 20 to 100 wt % of a polybutadiene…satisfying the relationship: $10B+5 \leq A \leq 10B+60$, wherein A is the Mooney viscosity(ML_{1+4} (100°C)) of the polybutadiene and B is the ratio Mw/Mn between the weight-average molecular weight Mw and the number-average molecular weight Mn of the polybutadiene"	Plain and ordinary meaning.	The base rubber composed of (a) 20 to 100 wt % of a polybutadiene that has the relationship: 10 times the polydispersity plus 5 is less than or equal to the Mooney viscosity which is less than or equal to 10 times the polydispersity plus 60. The term polydispersity means the ratio of the weight average molecular weight (Mw) to the number average molecular weight (Mn). As defined in the specification, "M" in the term (ML_{1+4} (100°C)) stands for Mooney viscosity, "L" stands for large rotor, "1+4" stands for a preheating time of 1 minute and a rotor rotation time of 4 minutes, and "100°C" indicates that the measurement was carried out at a temperature of 100°C."

Bridgestone submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 6,634,961: Abstract; Col. 2, lines 17-39; Col. 2, lines 58-65; Col. 3, lines 25-55; Col. 5, lines 47-53; Col. 6, line 61 to Col. 7, line 8; Col. 10, line 38 to Col. 14, line 8, including Examples and Tables; Col. 14, lines 12-22; Claims 1-9.

In the file history of US Patent 6,634,961: Application, p. 3, line 20 – p. 4, line 6; Application, p. 4, line 23-30; Application, p. 5, line 19 – p. 6, line 11; Application, p. 9, lines 13-19; Application p. 18, line 1 to p. 22, line 12, including Examples and Tables; Application, pp. 23-24; Application, p. 25, lines 1-18; Sept. 10, 2002 Office Action, pp. 2-8; Feb. 10, 2003 Amendment, pp. 4-6.

Acushnet submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 6,634,961: Abstract; Col. 2, lines 20-30; Col., 2, lines 58-65; Col. 3, lines 25-54; Col. 6, lines 61-68; Col. 7, lines 1-8; Col. 11 (Table 1); Col. 14, line 9-Col. 15, line 21.

In the file history of US Patent 6,634,961: Application, p. 4, lines 23-30; Application, p. 5, line 34- p. 6, line 11; Application, p. 25, lines 4-11; U.S. Patent No. 6,315,679 ("Thread Wound Golf Ball"): Col. 3, lines 36-42; U.S. Patent No. 4,955,613 ("Polybutadiene Golf Ball Product"): Col. 1, line 62-Col. 2, line 2; U.S. Patent No. 4,929,678 ("Rubber Composition and a Solid Golf Ball Obtained Therefrom"): Col. 1, lines 60-62; Col. 2, lines 19-21; Col. 3, lines 61-63; Col. 5, lines 36-37.

Cl.	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"(b) 0 to 80 wt % of a diene rubber other than component(a)"	Plain and ordinary meaning.	A diene rubber, different from diene rubber (a), that if present, is present in an amount not more than 80% by weight of the total rubber composition.

Bridgestone submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 6,634,961: Abstract; Col. 2, lines 17-50; Col. 5, line 47 to Col. 6, line 20; Col. 7, lines 9-15; Col. 10, line 38 to Col. 14, line 8, including Examples and Tables; Col. 14, lines 22-23; Claims 1-9.

In the file history of US Patent 6,634,961: Application, p. 3, line 20 – p. 4, line 16; Application, p. 9, line 7 - p. 10, line 7; Application, p. 11, lines 28-35; Application, p. 18, line 1 – p. 22, line 12, including Examples and Tables; Application, p. 23, lines 8-10; Sept. 10, 2002 Office Action, pp. 2-8; Feb. 10, 2003 Amendment, pp. 4-6.

Acushnet submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 6,634,961: Abstract; Col. 2, lines 20-31; Col. 5, lines 54-67; Col. 6, lines 1-19; Col. 14, line 9-Col. 15, line 22.

In the file history of US Patent 6,634,961: Application, p. 3, lines 23-34; Application, p. 9, lines 13-25; Application, p. 23, line 3-p. 24, line 6; Application, p. 25, lines 4-12.

Cl.	Claim Term	Bridgestone's Definition	Acushnet's Definition
2	"which has a cis-1,4 content of at least 60% and a 1,2 vinyl content of at most 5%, has a Mooney viscosity(ML_{1+4} (100° C)) of not more than 55, and satisfies the relationship: $\eta \leq 20A-550$, wherein A is the Mooney viscosity (ML_{1-4} (100° C)) of the second polybutadiene and η is the viscosity of the second polybutadiene, in mPa·s, at 25°C as a 5 wt % solution in toluene."	Plain and ordinary meaning.	Agree, plain meaning, with the further understanding that the specification defines "M" in the term (ML_{1+4} (100°C)) as "Mooney viscosity," 'L' stands for large rotor..., '1+4' stands for a preheating time of 1 minute and a rotor rotation time of 4 minutes and "100°C" indicates that the measurement was carried out at a temperature of 100°C." As defined in the specification, the viscosity η is defined as viscosity in mPa·s units obtained by dissolving 2.28g of the polybutadiene to be measured in 50 ml of toluene and carrying out measurement with a specified viscometer at 25°C using a standard solution for the viscometer (JIS Z8809).

Bridgestone submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 6,634,961: Col. 2, lines 17-50; Col. 5, line 47 to Col. 6, line 20; Col. 6, line 61 to Col. 7, line 15; Col. 10, line 38 to Col. 14, line 8, including Examples and Tables; Col. 15, lines 14-22; Claims 1-9.

In the file history of US Patent 6,634,961: Application, p. 3, line 20 – p. 4, line 16; Application, p. 9, line 7 - p. 10, line 7; Application, p. 11, lines 28-35; Application, p. 18, line 1 – p. 22, line 12, including Examples and Tables; Application, p. 23, lines 8-10; Sept. 10, 2002

Office Action, pp. 2-8; Feb. 10, 2003 Amendment, pp. 4-6.

Acushnet submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 6,634,961: Abstract; Col. 2, lines 20-31, 41-50, 58-68; Col. 3, lines 1-52; Col. 5, lines 54-67; Col. 6, lines 1-19; Col. 6, lines 61-67; Col. 7, lines 1-15; Col 11. (Table 1); Col. 14, line 9-Col. 15, line 22.

In the file history of US Patent 6,634,961: Application, p. 3, lines 23-34; Application, p. 4, lines 7-16, 23-30; Application, p. 5, lines 1-18; Application, p. 9, lines 13-33; Application, p. 6, lines 3-11; Application, p. 11, lines 28-35; Application, p. 23, line 3- p. 24, line 6; Application, p. 25, lines 4-12; Feb. 10, 2003 Amendment p. 1-2, 5, 8; U.S. Patent No. 6,315,679 ("Thread Wound Golf Ball"): Col. 3, lines 36-42; U.S. Patent No. 4,955,613 ("Polybutadiene Golf Ball Product"): Col. 1, line 62-Col. 2, line 2; U.S. Patent No. 4,929,678 ("Rubber Composition and a Solid Golf Ball Obtained Therefrom"): Col. 1, lines 60-62; Col. 2, lines 19-21; Col. 3, lines 61-63; Col. 5, lines 36-37.

IV. Bridgestone Patent US 5,743,817

The parties disagree on the following definition:

Cl.	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"cover consists of an ionomer resin as a resin component"	The resin component in the cover is ionomer resin.	"consists of" means that the resin component of the cover includes only one ionomer resin and excludes other resins or blends of ionomer resins.

Bridgestone submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 5,743,817: col. 4, lines 45-48; col. 5, lines 16-54, including Table 2; Col. 6, lines 54, 55; Claims 1-2; FIG. 1

In the file history of US Patent 5,743,817: Application, p. 7, lines 32-35; Application, p. 8, line 31 – p. 9, line 10; Application, p. 7, lines 32-35; Application, FIG. 1; March 4, 1997 Amendment, p. 1-8.

Acushnet submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 5,743,817: Col. 3, lines 29-32; Col. 4, lines 22-25, 45-48; Col. 6, lines 48-56.

In the file history of US Patent 5,743,817: Application, p. 6, lines 22-26; Application, p. 8, 11-15; Application, p. 12, lines 3-9; Sept. 3, 1996 Office Action, p. 3; March 4, 1997 Amendment, p. 1, 3-7; U.S. Patent No. 4,858,924 ("Solid Golf Ball"): Abstract; Col. 4, line 50-Col. 5, line 24; U.S. Patent No. 4,919,434 ("Golf Ball"): Col. 5, lines 16-23; Col. 6, lines 5-12, 52-68; U.S. Patent No. 5,304,608 ("Two-Piece Golf Ball"): Col. 3, lines 10-14; Table 1; GB 2 276 628 A ("Golf Balls"): page 1, line 25-page 2, line 14; page 3, line 17-page 4, line 22; page 5, line 8-page 7, line 2; page 11, Table 3; page 13, Table 4; page 17, Table 6; page 19, lines 3-14

V. Bridgestone Patent US 5,803,834

The parties agree as to the following definition:

Cl.	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"within 5 mm inside the core surface"	The hardness of each point within the region of the core which radially extends from the surface to a depth of 5mm in cross section.	

VI. Bridgestone Patent US 5,782,707

The parties agree as to the following definition:

Cl.	Claim Term	Bridgestone's Definition	Acushnet's Definition
1, 9	"core center hardness"	Hardness measured at the center of the core.	

VII. Bridgestone Patent US 6,679,791

The parties agree as to the following definitions:

Cl.	Claim Term	Bridgestone's Definition	Acushnet's Definition
13, 26	"core ...center"	The center of the core.	
13, 26	"JIS-C hardness" at core "surface"	Plain and ordinary meaning.	

The parties disagree on the following definitions:

Cl.	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"gradually increases"	Plain and ordinary meaning.	Having a slope which increases and is not steep or abrupt.

Bridgestone submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 6,679,791: Abstract, lines 5-7; col. 1, lines 41-43; col. 2, lines 6-9; col. 3, lines 5-15; col. 3, lines 26-45; col. 4, lines 1-8; Table 3, Examples 1 and 2, Comparative Examples 1-5; Col. 8, lines 59, 60; Claims 1-27; and FIG. 1.

In the file history of US Patent 6,679,791: Application, p. 2, lines 7-9; Application, p. 2, line 37 – p. 3, line 3; Application, p. 4, line 32 – p. 5, line 6; Application, p. 5, lines 17-21; Application, p. 6, lines 24-31; p. 12, Application, Table 3, Examples 1 and 2, Comparative Examples 1-5; Application p. 15; Application, FIG. 1; May 17, 2002 Office Action, pp. 2, 3; Aug. 15, 2002 Amendment, p. 2, 3, 5 and 6; Oct. 29, 2002 Office Action, pp. 2, 3; Jan. 29, 2003 Amendment, pp. 6, 7; Feb. 25, 2003 Interview Summary, p. 3; April 14, 2003 Office Action, p. 3; July 11, 2003 Amendment, p. 9.

Acushnet submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 6,679,791: Abstract; Col. 1, lines 41-45; Col. 2, lines 6-15; Col. 3, lines 5-15; Col. 3, lines 26 - 57; Col. 4, lines 1-8; Col. 5, lines 29 – 33; Col. 5, line

51 – Col. 6, line 14; Table 3; Col. 8, lines 51 - 62.

In the file history of US Patent 6,679,791: Application, p.2, lines 7-10; Application, p. 2, line 37 – p. 3, line 5; Application, p.5, line 17- p.6, line 13; Application, p. 6, lines 24-31; Application p. 9, lines 12-17; Application p. 10, lines 6-22; Application p. 12, Table 3; Application p. 15, lines 1 – 14; Application, p. 16; May 17, 2002 Office Action, pp. 2, 3; Aug. 15, 2002 Amendment, pp. 5 - 6; Oct. 29, 2002 Office Action, pp. 2, 3; Jan. 29, 2003 Amendment pp. 6-7; Feb. 25, 2003 Interview Summary, p. 3; April 14, 2003 Office Action, p. 3; July 11, 2003 Amendment, p. 9; U.S. Patent No. 5,002,281 ("Three-piece Solid Golf Ball"): Abstract; Col. 1, line 65 – Col. 2, line 10; Col. 3, lines 14-24; Col. 3, lines 44-55; Col. 6, lines 10-23; U.S. Patent No. 5,072,944 ("Three-piece Solid Golf Ball"): Abstract; Col. 3, lines 20-29; U.S. Patent No. 5,184,828 ("Solid Three-piece Golf Ball"): Col. 1, lines 48-60; Col. 2, lines 12 – 40; Col. 4, lines 47-61; col. 6, lines 16-21; Table 1; FIG 1; FIG 2; U.S. Patent No. 5,645,496 ("Two-piece Golf Ball"): Abstract; Col. 1, lines 40-57; Col. 2, lines 45-67; U.S. Patent No. 5,711,723 ("Three-piece Solid Golf Ball"): Abstract; Col. 1, lines 54-58; col. 2, lines 5-7; Col. 2, lines 12-31; U.S. Patent No. 5,782,707 ("Three-piece Solid Golf Ball"): Abstract; Col. 2, lines 5-51; Col. 3, lines 29-51; U.S. Patent No. 5,803,833 ("Two-piece Solid Golf Ball"): Abstract; Col. 1, line 47 – Col. 2, line 20; Col. 2, lines 35-67; Table 1; Col. 5, lines 33-46; Col. 6, lines 37-48; U.S. Patent No. 5,830,085 ("Three-piece Solid Golf Ball"): Abstract; Col. 2, lines 7-50; Col. 3, lines 5-41; Table 3; Table 4; Col. 9, line 57 – Col. 10, line 61; Col. 11, lines 1-13; U.S. Patent No. 6,190,269 ("Multi-piece Solid Golf Ball"): Col. 2, lines 6-19; Col. 4, lines 1-31; U.S. Patent No. 6,287,218 ("Solid Golf Ball"): Abstract; Col. 3, line 57- Col. 4, line 12; Col. 9, lines 25-29; U.S. Patent No. 6,315,682 ("Multi-piece Solid Golf Ball"): Col. 5, line 61 – Col. 6, line 11; U.S. Patent No. 6,319,155 ("Multi-piece Solid Golf Ball"): Col. 5, line 8-17; U.S. Patent No.

6,336,872 ("Multi-piece Solid Golf Ball"): Abstract; Col. 3, lines 15-48; Col. 5, line 60 – Col. 6, line 5; Table 5-8; Col. 12, lines 9-18; U.S. Patent No. 6,354,967 ("Solid Golf Ball"): Abstract; Col. 1, lines 35-46; Col. 2, lines 3-5; Col. 3, lines 39-57; U.S. Patent No. 6,379,268 ("Golf Ball"): Abstract; Col. 1, line 26 – Col. 2, line 40; Col. 3, lines 17-31; Table 4; Table 5.

Cl.	Claim Term	Bridgestone's Definition	Acushnet's Definition
13, 26	"a hardness at the center and a hardness at the surface thereof which is greater than the hardness at the center thereof."	Plain and ordinary meaning.	"a hardness at the center and a hardness at the surface thereof which is greater than the hardness at the center thereof, which gradually increases radially outward" "gradually increases" means "having a slope which increases and is not steep or abrupt."

Bridgestone submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 6,679,791: Abstract, lines 7-9; col. 1, lines 41-45; col. 2, lines 6-11; col. 3, lines 5-15; col. 3, lines 26-57; col. 4, lines 1-8; Table 3, Examples 1 and 2, Comparative Examples 1-5; col. 9, lines 46-48; Col. 9, lines 46-48; Col. 10, lines 39-41; Claims 1-27; FIG. 1.

In the file history of US Patent 6,679,791: Application, p. 2, lines 7-10; Application, p. 3, lines 3-5; Application, p. 4, line 32 – p. 5, line 6; Application, p. 5, lines 17-21; Application, p. 6, lines 24-31; p. 12, Application, Table 3, Examples 1 and 2, Comparative Examples 1-5; Application p. 15; Application, FIG. 1; May 17, 2002 Office Action, pp. 2, 3; Aug. 15, 2002 Amendment, p. 2, 3, 5 and 6; Oct. 29, 2002 Office Action, pp. 2, 3; Jan. 29, 2003 Amendment, pp. 6, 7; Feb. 25, 2003 Interview Summary, p. 3; April 14, 2003 Office Action, p. 3; July 11, 2003 Amendment, p. 9.

Acushnet submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 6,679,791: Abstract; Col. 1, lines 41-45; Col. 2, lines 6-15; Col. 2, line 23 - Col. 3, line 57; Col. 4, lines 1-8; Col. 5, lines 29 – 33; Col. 5, line 51 – Col. 6, line 14; Table 3; Col. 8, lines 51 - 62.

In the file history of US Patent 6,679,791: Application, p. 2, lines 7-10; Application, p. 2, line 37 – p. 3, line 5; Application, p.3, line 22 – p.6, line 13; Application, p. 6, lines 24-31; Application p. 9, lines 12-17; Application p. 10, lines 6-22; Application p. 12, Table 3; Application p. 15, lines 1 – 14; Application, p. 16; May 17, 2002 Office Action, pp. 2, 3; Aug. 15, 2002 Amendment, pp. 5 - 6; Oct. 29, 2002 Office Action, pp. 2, 3; Jan. 29, 2003 Amendment pp. 6-7; Feb. 25, 2003 Interview Summary, p. 3; April 14, 2003 Office Action, p. 3; July 11, 2003 Amendment, p. 9; U.S. Patent No. 5,002,281 ("Three-piece Solid Golf Ball"): Abstract; Col. 1, line 65 – Col. 2, line 10; Col. 3, lines 14-24; Col. 3, lines 44-55; Col. 6, lines 10-23; U.S. Patent No. 5,072,944 ("Three-piece Solid Golf Ball"): Abstract; Col. 3, lines 20-29; U.S. Patent No. 5,184,828 ("Solid Three-piece Golf Ball"): Col. 1, lines 48-60; Col. 2, lines 12 – 40; Col. 4, lines 47-61; col. 6, lines 16-21; Table 1; FIG 1; FIG 2; U.S. Patent No. 5,645,496 ("Two-piece Golf Ball"): Abstract; Col. 1, lines 40-57; Col. 2, lines 45-67; U.S. Patent No. 5,711,723 ("Three-piece Solid Golf Ball"): Abstract; Col. 1, lines 54-58; col. 2, lines 5-7; Col. 2, lines 12-31; U.S. Patent No. 5,782,707 ("Three-piece Solid Golf Ball"): Abstract; Col. 2, lines 5-51; Col. 3, lines 29-51; U.S. Patent No. 5,803,833 ("Two-piece Solid Golf Ball"): Abstract; Col. 1, line 47 – Col.2, line 20; Col. 2, lines 35-67; Table 1; Col. 5, lines 33-46; Col. 6, lines 37-48; U.S. Patent No. 5,830,085 ("Three-piece Solid Golf Ball"): Abstract; Col. 2, lines 7-50; Col. 3, lines 5-41; Table 3; Table 4; Col. 9, line 57 – Col. 10, line 61; Col. 11, lines 1-13; U.S. Patent No. 6,190,269 ("Multi-piece Solid Golf Ball"): Col. 2, lines 6-19; Col. 4, lines 1-31; U.S. Patent No.

6,287,218 ("Solid Golf Ball"): Abstract; Col. 3, line 57- Col. 4, line 12; Col. 9, lines 25-29; U.S. Patent No. 6,315,682 ("Multi-piece Solid Golf Ball"): Col. 5, line 61 – Col. 6, line 11; U.S. Patent No. 6,319,155 ("Multi-piece Solid Golf Ball"): Col. 5, line 8-17; U.S. Patent No. 6,336,872 ("Multi-piece Solid Golf Ball"): Abstract; Col. 3, lines 15-48; Col. 5, line 60 – Col. 6, line 5; Table 5-8; Col. 12, lines 9-18; U.S. Patent No. 6,354,967 ("Solid Golf Ball"): Abstract; Col. 1, lines 35-46; Col. 2, lines 3-5; Col. 3, lines 39-57; U.S. Patent No. 6,379,268 ("Golf Ball"): Abstract; Col. 1, line 26 – Col. 2, line 40; Col. 3, lines 17-31; Table 4; Table 5.

VIII. Acushnet Patent US 4,729,861

The parties agree as to the following definitions:

Cl	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	dimple "diameter"	The distance from edge to edge of a line passing through the center of the dimple when the dimple is circular. When the dimple is non-circular, diameter is the diameter of a circle which would have the same area as the non-circular dimple.	
1	dimple "depth"	The distance from the continuation of the periphery line of the golf ball to the deepest part of a dimple which is a section of a sphere. When the dimple is not a section of a sphere, the depth is determined by computing the cross-section area of the dimple at its widest point and then creating a section of a circle having an equal area which is substituted for the dimple, where the depth is the distance from the continuation of the periphery line to the deepest part of the section of the circle.	
1	"average"	Arithmetic mean.	
1	"adjacent dimple"	A dimple in which a triangle constructed of lines passing through the center points of three (3) dimples has no included angle less than about 30 degrees, and has no part of another dimple included therein.	

Cl.	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"closest points"/"closest distances"	Closest points: The points on the edges of adjacent dimples which yield the shortest land distance between the dimples on a line passing through the centers of adjacent dimples. Closest distances: The land distance between the edges of two dimples at their closest points on a line passing through the centers of adjacent dimples.	
1	"periphery of the golf ball or its continuation"	The outermost surface of the golf ball or an imaginary plane corresponding to the outermost surface of the golf ball.	
1	"finishing the golf ball"	Completing the ball in the form in which it is intended to be sold to the consumer, whether painted or unpainted.	
1	"about"	In light of statements made to the PTO during prosecution of these patents, the term 'about' means 'miniscule variations.	

The parties disagree on the following definitions:

Cl	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"determining the dimple number, dimple diameter and dimple depth by: (a) selecting the number of dimples to be used, the said number of dimples being between 182 and 392; (b) selecting a dimple diameter and dimple depth that satisfy the following relationship: $S=\left[\frac{831.5(d-x)-55.56(D-y)}{a}\right]^4+\left[\frac{83.15(D-y)+555.6(d-x)}{b}\right]^4$ in which: S= a value of 0 to 1.0 d = average depth of all dimples in inches D = average diameter of all dimples in inches and wherein: A value N is obtained by dividing the exact number of dimples by 100, and x, y, a and b are defined by the following relations as functions of N: when the number of dimples is between 182 and 332: $y = 0.323 - 0.0896N + 0.0122N^2$ $x = 0.0186 - 0.00406N + 0.000550N^2$ $a = 6.30 - 3.30N + 0.693N^2$ $b = 3.11 - 1.03N + 0.155N^2$ and when the number of dimples is between 333 and 392: $y = 0.287 - 0.0383N$ $x = 0.0162 - 0.00150N$ $a = 4.66 - 0.500N$ $b = 5.00 - 1.08N$"	Determining the number of dimples to be used selecting the number of dimples to be between 182 and 392 and determining the dimple diameter and depth by selecting the dimple diameter and depth using the relationship: $S=\left[\frac{831.5(d-x)-55.56(D-y)}{a}\right]^4+\left[\frac{83.15(D-y)+555.6(d-x)}{b}\right]^4$ in which: S= a value of 0 to 1.0 d = average depth of all dimples in inches D = average diameter of all dimples in inches and wherein: A value N is obtained by dividing the exact number of dimples by 100, and x, y, a and b are defined by the following relations as functions of N: when the number of dimples is between 182 and 332: $y = 0.323 - 0.0896N + 0.0122N^2$ $x = 0.0186 - 0.00406N + 0.000550N^2$ $a = 6.30 - 3.30N + 0.693N^2$ $b = 3.11 - 1.03N + 0.155N^2$ and when the number of dimples is between 333 and 392: $y = 0.287 - 0.0383N$ $x = 0.0162 - 0.00150N$ $a = 4.66 - 0.500N$ $b = 5.00 - 1.08N$	Plain Meaning

Bridgestone submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 4,729,861: Col. 3, line 51 to col. 5, line 24; col. 7, line 63 to col. 8, line 30; and col. 9, lines 32 to 49

In the file history of US Patent 4,729,861: Application p. 7, line 5 to p. 11, line 6, p. 17 to p. 18, line 18; March 10, 1985 Amendment Concurrent with Filing, p. 1-6; March 10, 1986 Office Action, p. 1-2; June 9, 1986 Amendment pp. 1-12; September 10, 1986 Office Action, p.

1-3; January 12, 1987 Amendment pp. 1-3, and attachments; May 7, 1987 Office Action, p. 1-2; June 9, 1987 Amendment, p. 1-11; September 14, 1987 Office Action, p. 1-3; October 6, 1987 Amendment, p. 1-2 and attachments; and within the file history of US Patent 4,936,587 (US Application No. 06/213,056 filed December 4, 1980: September 20, 1984 Amendment, pp. 1-3; February 11, 1985 Restriction/Election Requirement, pp. 1-4; March 10, 1985 Election Response, pp. 1-2; Interview Summary dated July 3, 1986 p. 1; and August 10, 1987 Amendment, pp. 13 and 17-18

Acushnet submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 4,729,861: Col. 3, line 51 to Col. 5, line 24; Col. 7, line 63 to Col. 8, line 30; and Col. 9, lines 32 to 49

In the file history of US Patent 4,729,861: Application p. 7, line 5 to p. 11, line 6, p. 17 to p. 18, line 18; March 10, 1985 Amendment Concurrent with Filing, p. 1-6; March 10, 1986 Office Action, p. 1-2; June 9, 1986 Amendment pp. 1-12; September 10, 1986 Office Action, p. 1-3; January 12, 1987 Amendment pp. 1-3, and attachments; May 7, 1987 Office Action, p. 1-2; June 9, 1987 Amendment, p. 1-11; September 14, 1987 Office Action, p. 1-3; October 6, 1987 Amendment, p. 1-2 and attachments; and within the file history of US Patent 4,936,587 (US Application No. 06/213,056 filed December 4, 1980: September 20, 1984 Amendment, pp. 1-3; February 11, 1985 Restriction/Election Requirement, pp. 1-4; March 10, 1985 Election Response, pp. 1-2; Interview Summary dated July 3, 1986 p. 1; and August 10, 1987 Amendment, pp. 13 and 17-18.

Cl.	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"edge"	The point of intersection of the periphery of the golf ball or its continuation and a tangent to the sidewall of the dimple at a point 0.003 inches below the periphery of the golf ball or its continuation.	The intersection of the periphery of the golf ball or its continuation and a tangent to the sidewall of the dimple at a point 0.003 inches below the periphery of the golf ball or its continuation.

Bridgestone submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 4,729,861: Col. 1, lines 42-45; Col. 6, lines 15-50; Col. 10, lines 45-48 (claim 1); Fig. 3-5, 14-18

In the file history of US Patent 4,729,861: Application p. 2 lines 14-17, p. 13, line 12 to p. 14, line 19, pp. 22-29 and Figs. 3-5, 14-18; March 10, 1985 Amendment Concurrent with Filing, pp. 1-6; June 9, 1986 Amendment pp. 1-12; January 12, 1987 Amendment pp. 1-3; June 9, 1987 Amendment, p. 1-11; October 6, 1987 Amendment, p. 1-2; and within Prosecution of U.S. Application No. 05/236,318 filed March 20, 1972, January 1, 1973 Amendment, pp. 2 to 6, and 11.

Acushnet submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 4,729,861: Col. 1, lines 42-45; Col. 5, line 67 – Col. 6, line 2; Col. 6, lines 15-50; Col. 6, line 66 – Col. 7, line 7; Col. 8, lines 40-66; Col. 9, lines 1-31; Claims 1-3, 6-7, 10-11, 14-15, 18-19, and 22-23; Fig. 2, 3-6, 14-18.

In the related file history of US Patent 4,729,861: Application No. 236,318, January 8, 1973 Amendment, pp. 2-6, 11-12.

In the file history of US Patent 4,729,861: Application p. 2 lines 14-17, p. 13, line 12 to p. 14, line 19, pp. 22-29 and Figs. 3-5, 14-18; March 10, 1985 Amendment Concurrent with Filing, pp. 1-6; June 9, 1986 Amendment pp. 1-12; January 12, 1987 Amendment pp. 1-3; June 9, 1987 Amendment, p. 1-11; October 6, 1987 Amendment, p. 1-2; and within Prosecution of

U.S. Application No. 05/236,318 filed March 20, 1972, January 1, 1973 Amendment, pp. 2 to 6, and 11.

IX. Acushnet Patent US 4,936,587

The parties agree as to the following definitions:

Cl	Claim Term	Bridgestone's Definition	Acushnet's Definition
1, 26	"A finished golf ball which has from 182 to 392 dimples"	A completed golf ball in the form in which it is intended to be sold to the consumer, whether painted or unpainted, having 182 to 392 dimples	
1, 26	dimple "diameter"	The distance from edge to edge of a line passing through the center of the dimple when the dimple is circular. When the dimple is non-circular, diameter is the diameter of a circle which would have the same area as the non-circular dimple.	
1, 26	dimple "depth"	The distance from the continuation of the periphery line of the golf ball to the deepest part of a dimple which is a section of a sphere. When the dimple is not a section of a sphere, the depth is determined by computing the cross-section area of the dimple at its widest point and then creating a section of a circle having an equal area which is substituted for the dimple, where the depth is the distance from the continuation of the periphery line to the deepest part of the section of the circle.	
1, 26	"average"	Arithmetic mean.	
1, 26	"adjacent dimple"	A dimple in which a triangle constructed of lines passing through the center points of three (3) dimples has no included angle less than about 30 degrees, and has no part of another dimple included therein.	
1	"closest points"	Closest points: The points on the edges of adjacent dimples which yield the shortest land distance between the dimples on a line passing through the centers of adjacent dimples.	
1	"periphery of the golf ball or its continuation"	The outermost surface of the golf ball or an imaginary plane corresponding to the outermost surface of the golf ball.	
1	"about"	In light of statements made to the PTO during prosecution of these patents, the term 'about' means 'miniscule variations.	

The parties disagree on the following definitions:

Cl	Claim Term	Bridgestone's Definition	Acushnet's Definition
1, 26	"edge"	The point of intersection of the periphery of the golf ball or its continuation and a tangent to the sidewall of the dimple at a point 0.003 inches below the periphery of the golf ball or its continuation.	The intersection of the periphery of the golf ball or its continuation and a tangent to the sidewall of the dimple at a point 0.003 inches below the periphery of the golf ball or its continuation.

Bridgestone submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 4,936,587: Col. 1, lines 39-42; Col. 6, lines 3-31; Col. 9, lines 61-64 (claim 1); Col. 13, lines 47-49 (claim 26); Fig. 3-5, 14-18

In the file history of US Patent 4,936,587: Application p. 2, lines 14-17, p. 13 line 12 to p. 14 line 19, pp. 22 to 29, and Figs. 3-5 and 14-18; Preliminary Amendment dated November 26, 1980, pp. 1-12; Amendment Before Action dated October 29, 1981, p. 1; Amendment dated April 24, 1984, pp. 2-14; Supplemental Amendment dated April 25, 1984, pp. 1-4; Provisional Election dated August 2, 1984, pp. 1-4; Supplemental Amendment dated September 20, 1984, pp. 1-3; Amendment dated March 10, 1986, pp. 1-13, 18-25; Supplemental Amendment dated April 10, 1986, p. 1; Amendment dated August 10, 1987, pp. 1-22; Amendment dated January 18, 1988, pp. 2-3; Amendment dated Feb. 7, 1990, pp. 1-3 and attachments; Amendment dated Apr. 16, 1990, pp. 1-6, 9-13; and within the Prosecution of U.S. Application No. 05/236,318 filed March 20, 1972, January 1, 1973 Amendment, pp. 2 to 6, and 11

Acushnet cites the following intrinsic evidence as supporting its definition:

In the specification of US Patent 4,936,587: Abstract; Col. 1, lines 30-46; Col. 1, lines 61-66; Col. 2, lines 12-18; Col. 5, line 38 – Col. 6, line 31; Col. 6, lines 38-56; Col. 8, line 21 – Col. 9, line 10; Claims 1-37; Figs. 3-5, 14-18.

In the related file history of US Patent 4,936,587: Application No. 236,318, January 8, 1973 Amendment, pp. 2-6, 11-12.

In the file history of US Patent 4,936,587: Application p. 2, lines 14-17, p. 13 line 12 to p. 14 line 19, pp. 22 to 29, and Figs. 3-5 and 14-18; Preliminary Amendment dated November 26, 1980, pp. 1-12; Amendment Before Action dated October 29, 1981, p. 1; Amendment dated April 24, 1984, pp. 2-14; Supplemental Amendment dated April 25, 1984, pp. 1-4; Provisional Election dated August 2, 1984, pp. 1-4; Supplemental Amendment dated September 20, 1984, pp. 1-3; Amendment dated March 10, 1986, pp. 1-13, 18-25; Supplemental Amendment dated April 10, 1986, p. 1; Amendment dated August 10, 1987, pp. 1-22; Amendment dated January 18, 1988, pp. 2-3; Amendment dated Feb. 7, 1990, pp. 1-3 and attachments; Amendment dated Apr. 16, 1990, pp. 1-6, 9-13; and within the Prosecution of U.S. Application No. 05/236,318 filed March 20, 1972, January 1, 1973 Amendment, pp. 2 to 6, and 11.

X. Acushnet Patent US 5,080,367

The parties agree as to the following definitions:

Cl	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"A finished, painted golf ball which has from about 182 to about 392 dimples"	A completed golf ball in the form in which it is intended to be sold to the consumer having at least one paint layer and about 182 to about 392 dimples	
1	dimple "diameter"	The distance from edge to edge of a line passing through the center of the dimple when the dimple is circular. When the dimple is non-circular, diameter is the diameter of a circle which would have the same area as the non-circular dimple.	

Cl	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	dimple "depth"	The distance from the continuation of the periphery line of the golf ball to the deepest part of a dimple which is a section of a sphere. When the dimple is not a section of a sphere, the depth is determined by computing the cross-section area of the dimple at its widest point and then creating a section of a circle having an equal area which is substituted for the dimple, where the depth is the distance from the continuation of the periphery line to the deepest part of the section of the circle.	
1	"average"	Arithmetic mean.	
1	"adjacent dimple"	A dimple in which a triangle constructed of lines passing through the center points of three (3) dimples has no included angle less than about 30 degrees, and has no part of another dimple included therein.	
1, 3	"closest points"	Closest points: The points on the edges of adjacent dimples which yield the shortest land distance between the dimples on a line passing through the centers of adjacent dimples.	
1	"periphery of the golf ball or its continuation"	The outermost surface of the golf ball or an imaginary plane corresponding to the outermost surface of the golf ball.	
1	"about"	In light of statements made to the PTO during prosecution of these patents, the term 'about' means 'miniscule variations.	

The parties disagree on the following definitions:

Cl	Claim Term	Bridgestone's Definition	Acushnet's Definition
1, 3	"edge"	The point of intersection of the periphery of the golf ball or its continuation and a tangent to the sidewall of the dimple at a point 0.003 inches below the periphery of the golf ball or its continuation.	The intersection of the periphery of the golf ball or its continuation and a tangent to the sidewall of the dimple at a point 0.003 inches below the periphery of the golf ball or its continuation.

Bridgestone submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 5,080,367: Col. 1, lines 42-45; Col. 6, lines 8-37; Col. 9, line 66 to col. 10, line 2 (claim 1); Figs. 3-5; 14-18.

In the file history of US Patent 5,080,367: Application p. 2, lines 14-17, p. 13 line 12

to p. 14 line 19, pp. 22 to 29, and Figs. 3-5 and 14-18; Preliminary Amendment dated June 26, 1990, pp. 2-9; Amendment dated March 4, 1991, pp. 3-11; and within the Prosecution of U.S. Application No. 05/236,318 filed March 20, 1972, January 1, 1973 Amendment, pp. 2 to 6, and 11.

Acushnet submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 5,080,367: Abstract; Col. 1, lines 33-49; Col. 1, line 59 – Col. 2, line 1; Col. 2, lines 15-21; Col. 5, line 43 – Col. 6, line 37; Col. 6, lines 44-62; Col. 8, line 27 – Col. 9, line 16; Claims 1-25; Figs. 2-5, 14-18.

In the related file history of US Patent 5,080,367: Application No. 236,318, January 8, 1973 Amendment, pp. 2-6, 11-12.

In the file history of US Patent 5,080,367: Application p. 2, lines 14-17, p. 13 line 12 to p. 14 line 19, pp. 22 to 29, and Figs. 3-5 and 14-18; Preliminary Amendment dated June 26, 1990, pp. 2-9; Amendment dated March 4, 1991, pp. 3-11; and within the Prosecution of U.S. Application No. 05/236,318 filed March 20, 1972, January 1, 1973 Amendment, pp. 2 to 6, and 11.

XI. Acushnet Patent US 6,818,705

The parties agree as to the following definitions:

Cl.	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"cis-to-trans catalyst"	Any component or a combination thereof that will convert at least a portion of cis-polybutadiene isomer to trans-polybutadiene isomer at a given temperature.	
1	"about"	In this patent, "about," when used in connection with one or more numbers or numerical ranges, should be understood to refer to all such numbers, including all numbers in a range.	

The parties disagree as to the following definitions:

Cl.	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"a material farmed from the conversion reaction of at least a cis-to-trans catalyst and a polybutadiene"	A cured product formed from the conversion reaction of at least a cis-to-trans catalyst and a polybutadiene.	Plain meaning, with the term "farmed" meaning "formed."

Bridgestone submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 6,818,705: Col. 1, lines 23-26; Col. 1, lines 41-43; Col. 6, lines 34-51; Col. 8, lines 5-22; Col. 8, line 66 to Col. 9, line 5; Col. 11, lines 50-61; Col. 11, line 62 to Col. 12, line 30; Col. 11, lines 32-44; Col. 13, lines 27-32; Col. 14, lines 20-32; Col. 14, line 33 to Col. 15, line 39; Col. 16, line 40 to Col. 17, line 56; Col. 17, line 57 to Col. 18, line 9; Col. 24, lines 18-55; Col. 26, lines 54-57; Col. 27 to Col. 30, including Tables 3-4; Col. 32, lines 38-41; Col. 32, line 47 to Col. 33, line 31, including Table 6; Claims 1-22.

In the file history of US Patent 6,818,705: Originally filed Specification at claim 1; Non-Final Office Action mailed Feb. 25, 2004 at pp. 1-4; Response to Office Action (Amendment) filed May 25, 2004 at pp. 2, 6-9; Terminal Disclaimer filed May 25, 2004 at pp. 1-2; and Notice of Allowability mailed July 30, 2004 at pp. 1-2.

Acushnet submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 6,818,705: Abstract; Col. 1, lines 23-26; Col. 5, lines 43-46; Col. 6, lines 34-51; Col. 7, lines 10-13; Col. 8, lines 5-22; Col. 8, lines 33-36; Col. 8, lines 41-44; Col. 8, line 66 to Col. 9, line 5; Col. 10, lines 31-63; Col. 11, lines 13-26;Col. 12, lines 28-42; Col. 14, lines 20-43; Col. 25, lines 5-67, including Table 1; Claims 1, 3, 8, 15, 16, and 20.

In the file history of US Patent 6,818,705: Originally filed Specification at claim 1; Non-Final Office Action mailed Feb. 25, 2004 at pp. 1-4; Response to Office Action

(Amendment) filed May 25, 2004 at pp. 2, 6-9; Terminal Disclaimer filed May 25, 2004 at pp. 1-2; and Notice of Allowability mailed July 30, 2004 at pp. 1-2.

Cl	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"the material has a molecular weight of greater than about 200,000 and a resilience index of at least about 40"	"the material" refers to "a material" preceding it in the claim, is defined as set forth above, and the material has a molecular weight of greater than about 200,000 and a resilience index of at least about 40.	Plain meaning.

Bridgestone submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 6,818,705: Col. 1, lines 23-26; Col. 12, lines 28-30; Col. 24, lines 18-55; Col. 26, line 25 to Col. 33, line 31, including Examples and Tables 2-6; Claims 1, 8, 15, 16.

In the file history of US Patent 6,818,705: Originally filed Specification at claim 1; Non-Final Office Action mailed Feb. 25, 2004 at pp. 1-4; Response to Office Action (Amendment) filed May 25, 2004 at pp. 2, 6-9; Terminal Disclaimer filed May 25, 2004 at pp. 1-2; and Notice of Allowability mailed July 30, 2004 at pp. 1-2.

Acushnet submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 6,818,705: Abstract; Col. 1, lines 23-26; Col. 5, lines 43-46; Col. 6, lines 34-51; Col. 7, lines 10-13; Col. 8, lines 5-22; Col. 8, lines 33-36; Col. 8, lines 41-44; Col. 8, line 66 to Col. 9, line 5; Col. 10, lines 31-63; Col. 11, lines 13-26;Col. 12, lines 28-42; Col. 14, lines 20-43; Col. 25, lines 5-67, including Table 1; Claims 1, 3, 8, 15, 16, and 20.

In the file history of US Patent 6,818,705: Originally filed Specification at claim 1; Non-Final Office Action mailed Feb. 25, 2004 at pp. 1-4; Response to Office Action

(Amendment) filed May 25, 2004 at pp. 2, 6-9; Terminal Disclaimer filed May 25, 2004 at pp. 1-2; and Notice of Allowability mailed July 30, 2004 at pp. 1-2.

Cl.	Claim Term	Bridgestone's Definition	Acushnet's Definition
1	"resilience index"	The difference in loss tangent measured at 10 cpm and 1000 cpm divided by 990 (the frequency span) multiplied by 100,000 (for normalization and unit convenience).	The difference in loss tangent measured at 10 cpm and 1000 cpm divided by 990 (the frequency span) multiplied by 100,000 (for normalization and unit convenience). The loss tangent is measured using an RPA 2000 manufactured by Alpha Technologies of Akron, Ohio. The RPA 2000 is set to sweep from 2.5 to 1000 cpm at a temperature of 100° C using an arc of 0.5 degrees. An average of six loss tangent measurements are acquired at each frequency and the average is used in calculation of the resilience index.

Bridgestone submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 6,818,705: Col. 9, line 55 to Col. 10, line 17; Col. 11, lines 13-16; Col. 11, lines 23-26; Claims 1, 3, 8, 15, 16, 20.

In the file history of US Patent 6,818,705: Originally filed Specification at claims 1 and 3; Non-Final Office Action mailed Feb. 25, 2004 at pp. 1-4; Response to Office Action (Amendment) filed May 25, 2004 at pp. 2, 6-9; Terminal Disclaimer filed May 25, 2004 at pp. 1-2; and Notice of Allowability mailed July 30, 2004 at pp. 1-2.

Acushnet submits that at least the following intrinsic evidence supports its definition.

In the specification of US Patent 6,818,705: Col. 11, lines 13-26; Claims 1, 16, and 20.

In the file history of US Patent 6,818,705: Originally filed Specification at claim 1; Non-Final Office Action mailed Feb. 25, 2004 at pp. 1-4; Response to Office Action (Amendment) filed May 25, 2004 at pp. 2, 6-9; Terminal Disclaimer filed May 25, 2004 at pp. 1-2; and Notice of Allowability mailed July 30, 2004 at pp. 1-2.

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November 1, 2006

EXHIBIT 4

IN UNITED STATES DISTRICT COURT
DISTRICT OF DELAWARE

BRIDGESTONE SPORTS CO., LTD., and BRIDGESTONE GOLF, INC., *Plaintiffs,* *v.* **ACUSHNET COMPANY,** *Defendant.*	C.A. No. 05-132(JJF) DEMAND FOR JURY TRIAL

EXPERT REPORT OF LARRY C. CADORNIGA

CONTAINS HIGHLY CONFIDENTIAL INFORMATION SUBJECT TO PROTECTIVE ORDER

EXHIBIT F

ACUSHNET'S INFRINGEMENT OF U.S. PATENT NO. 5,803,834

I understand that the ◀NXT▶, ◀-NXT-▶, DT So/Lo, ◀DT So/Lo▶, PTS So/Lo, ◀PTS So/Lo▶, Pinnacle Exception and Exception golf balls are accused of infringing claim 1 of U.S. Patent No. 5,803,834. In this Exhibit, I use the term "accused Acushnet golf balls" to refer to the ◀NXT▶, ◀-NXT-▶, DT So/Lo, PTS So/Lo, ◀DT So/Lo▶, ◀PTS So/Lo▶, Pinnacle Exception and Exception golf balls. Based on the information that I have considered and my experience, it is my opinion that each of these golf balls infringes claim 1 of the '834 patent.

I. U.S. Patent No. 5,803,834

A. Summary

United States Patent 5,803,834 ("the '834 patent"), entitled *Two-Piece Solid Golf Ball*, issued on September 8, 1998. Messrs. Hisashi Yamagishi and Jun Shindo are the inventors of the inventions disclosed in the '834 patent.

The '834 patent relates to solid golf balls having increased flight distance, controllability and hitting feel. The golf ball of the invention contains a solid core and a cover and achieves the above characteristics by various relative physical properties between the components of the golf ball.

B. Asserted Claim

I understand that Bridgestone has asserted only claim 1 of the '834 patent. Claim 1 of the '834 patent reads:

> 1. A two-piece solid golf ball comprising a solid core and a cover enclosing the core and having a number of dimples in its surface, wherein said solid core has such a distribution of hardness as measured by a JIS-C scale hardness meter that a surface hardness is up to 85 degrees, a center

hardness is lower than the surface hardness by not less than 8 to less than 20 degrees, and a hardness within 5 mm inside the core surface is up to 8 degrees lower than the surface hardness, said cover has a hardness which is higher than the surface hardness of the core by 1 to 15 degrees and a gage of 1.5 to 1.95 mm, and the number of dimples is 360 to 450.

C. Claim Construction Issues

I understand that the claim term "within 5 mm inside the core surface" has been defined by the parties to mean "the hardness of each point within the region of the core which radially extends from the surface to a depth of 5 mm in cross section." I understand that with the exception of this claim term, no other claim terms are in dispute or have been given agreed-upon constructions by the parties.

D. Accused Acushnet Golf Balls

I understand that golf balls manufactured and sold by Acushnet having the sidestamps shown in Table F-1 are alleged to infringe claim 1 of the '834 patent. As used in this Exhibit to my report, the term "accused Acushnet golf balls" means the golf balls made and sold by Acushnet having the sidestamps identified in Table F-1.

Accused Acushnet Golf Balls for Claim 1 of the '834 Patent			
◀NXT▶	◀-NXT-▶	DT So/Lo	◀DT So/Lo▶
PTS So/Lo	◀PTS So/Lo▶	Pinnacle Exception	Exception

Table F-1

It is my understanding that the DT So/Lo and PTS So/Lo golf balls are identical but for their sidestamps.[1] Similarly, I understanding that the ◀DT So/Lo▶ and ◀PTS So/Lo▶ golf balls are identical but for their sidestamps. Any reference herein to the DT So/Lo golf ball

[1] Jordan Depo. at p. 17-18; Welchman Depo. at p. 115; Acushnet 30(b)(6) Depo. (Dalton) of July, 21, 2006 at p. 329; Bartsch Depo. at p. 11.

includes the PTS So/Lo golf ball and any reference to the ◀DT So/Lo▶ golf ball includes the ◀PTS So/Lo▶ golf ball.

II. Infringement Analysis by Claim Term

A. "two-piece solid golf ball"

I understand that the preamble of a claim is typically not considered a limitation. Nonetheless, in view of my review of the testing data provided by Dr. Caulfield, my review of documents produced by Acushnet, specifically the competitive ball reports and the manufacturing guidelines, my review of deposition testimony, and my understanding of the construction of the accused Acushnet golf balls as a person with more than 30 years experience in the field of golf ball design and development, it is my opinion that each of the accused Acushnet golf balls is a "two-piece solid golf ball."

Acushnet's competitive ball reports and USGA submissions, among many other documents, also support my opinion. I also understand that this Acushnet has never disputed that the accused Acushnet golf balls are "two-piece solid golf ball[s]" as that term is used in claim 1 of the '817 patent.

B. "solid core"

In view of my review of at least the testing data provided by Mr. Caulfield, my review of documents produced by Acushnet, specifically the competitive ball reports and the manufacturing guidelines, my review of deposition testimony, and my understanding of the construction of the accused Acushnet golf balls as a person with more than 30 years experience in the field of golf ball design and development, it is my opinion that each of the accused Acushnet golf balls is a golf ball having a "solid core."

Acushnet's competitive ball reports and USGA submissions, among many other documents, also support my opinion. I also understand that this Acushnet has never disputed that the accused Acushnet golf balls have "solid core[s]" as that term is used in claim 1 of the '817 patent.

C. "cover enclosing the core and having a number of dimples in its surface"

In view of my review of at least the testing data provided by Mr. Caulfield, my review of documents produced by Acushnet, specifically the competitive ball reports and the manufacturing guidelines, my review of deposition testimony, and my understanding of the construction of the accused Acushnet golf balls as a person with more than 30 years experience in the field of golf ball design and development, it is my opinion that each of the accused Acushnet golf balls is a golf ball having a "cover enclosing the core and having a number of dimples in its surface."

Acushnet's competitive ball reports and USGA submissions, among many other documents, also support my opinion. I also understand that this Acushnet has never disputed that the accused Acushnet golf balls have a "cover enclosing the core and having a number of dimples in its surface" as that term is used in claim 1 of the '817 patent.

D. "solid core has such a distribution of hardness as measured by a JIS-C scale hardness meter that a surface hardness is up to 85 degrees"

In view of my review of at least the testing data provided by Mr. Caulfield, my review of documents produced by Acushnet, specifically the competitive ball reports and the manufacturing guidelines, my review of deposition testimony, and my understanding of the construction of the accused Acushnet golf balls as a person with more than 30 years experience in the field of golf ball design and development, it is my opinion that each of the accused

Acushnet golf balls having wherein a "solid core has such a distribution of hardness as measured by a JIS-C scale hardness meter that a surface hardness is up to 85 degrees."

Claim 1 of the '834 patent includes elements directed to four hardness measurements of a golf ball's components and the absolute and relative values of those hardness. The first hardness measurement recited in this claim is the surface hardness of the core when measured on a JIS-C scale. As recited in the claim, this hardness can be "up to 85 degrees."

Dr. Caulfield has performed hardness testing of the core surface of the accused Acushnet golf balls. A summary of the results of this testing are included in Table F-2. I have reviewed this data in arriving at my opinions.

Sidestamp	Mean Core Surface Hardness (JIS-C)
◀NXT▶	83.2
◀-NXT-▶	81.8
DT So/Lo PTS SoLo	85.3
◀DT So/Lo▶ ◀PTS So/Lo▶	82.1
Pinnacle Exception	83.5
Exception	79.1

Table F-2.

I have also reviewed certain Acushnet documents that identify the surface hardness of the core of the accused Acushnet golf balls. For example, entries from Acushnet's competitive ball database show that Acushnet measured the ◀DT So/Lo▶ golf ball as having a Shore C hardness[2] of 80 (AB 4645), the DT So/Lo golf ball as having a Shore C hardness of 80-81 (AB

[2] Although not identical, Shore C hardness is roughly comparable to JIS-C hardness. (*See* Acushnet 30(b)(6) Depo. of August 22, 2006 at p. 162 ("We also use JIS-C, which is very similar to Shore C.") and Jordan Depo. at pages 280-281.

4629, AB 4623), and the NXT as having a Shore C hardness of 79 (AB 4660, AB 4663). These documents reveal that Dr. Caulfield's testing data is consistent with testing data arrived in a non-litigation context at Acushnet,[3] confirming my belief that Dr. Caulfield's testing protocols and methods were appropriate.

Based on my review of these materials, it is my opinion that each of the accused Acushnet golf balls has a solid core with a surface hardness "up to 85 degrees" on a JIS-C scale. The core surface hardness for each of these golf balls is less than or equal to 85 degrees. Accordingly, it is my opinion that each of the accused Acushnet golf balls has a surface hardness of the core that is "up to 85 degrees" on a JIS-C scale.

E. "center hardness is lower than the surface hardness by not less than 8 to less than 20 degrees"

In view of my review of at least the testing data provided by Mr. Caulfield, my review of documents produced by Acushnet, specifically the competitive ball reports and the manufacturing guidelines, my review of deposition testimony, and my understanding of the construction of the accused Acushnet golf balls as a person with more than 30 years experience in the field of golf ball design and development, it is my opinion that each of the accused Acushnet golf balls are golf balls wherein a "center hardness is lower than the surface hardness by not less than 8 to less than 20 degrees."

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[3] As shown in the testing data provided by Mr. Caulfield, a batch of golf balls bearing the sidestamps ◁DT So/Lo▷ and Exception contained cores which were slightly different in hardness and in color than cores found in most other golf balls bearing the same sidestamps. I understand from the testimony of Mr. Ken Welchman, Acushnet's Director of Quality, and Mr. Eric Bartsch, Acushnet's Director of Manufacturing, that Acushnet never uses cores in its DT So/Lo and Pinnacle Exception brand golf balls other than the cores specified for those golf balls. Accordingly, it is my opinion that these balls having slightly different hardnesses and core color are properly included with the testing group.

Dr. Caulfield has also performed hardness testing of the center of the core of the accused Acushnet golf balls. A summary of the results of his data are included in Table F-3. I have reviewed this data in arriving at my opinions.

Sidestamp	Mean Core Surface Hardness (JIS-C)	Mean Core Center Hardness (JIS-C)	Difference
	A	*B*	*A-B*
◀NXT▶	83.2	61.7	21.5
◀-NXT-▶	81.8	60.4	21.4
DT So/Lo PTS SoLo	85.3	63.1	22.2
◀DT So/Lo▶ ◀PTS So/Lo▶	82.1	61.8	20.3
Pinnacle Exception	83.5	61.0	22.5
Exception	79.1	62.0	17.1

Table F-3.

I have also reviewed certain Acushnet documents that identify the hardness at the center of the cores of the accused Acushnet golf balls. For example, entries from Acushnet's competitive ball database show that Acushnet measured the ◀DT So/Lo▶ golf ball as having a Shore C core center hardness of 60 (AB 4645), the DT So/Lo golf ball as having a Shore C hardness of 58/60 (AB 4630, AB 4623), and the NXT as having a Shore C hardness of 56/63 (AB 4661, AB 4664). These documents reveal that Dr. Caulfield's testing data is consistent with testing data arrived in a non-litigation context at Acushnet, confirming my belief that Dr. Caulfield's testing protocols and methods were appropriate.

Based on my review of these materials, it is my opinion that each of the accused Acushnet golf balls has a solid core wherein the "center hardness is lower than the surface hardness by not less than 8 to less than 20 degrees." (See Table F-3).

To the extent the golf balls bearing the sidestamps ◀NXT▶, ◀-NXT-▶, DT So/Lo, PTS So/Lo, ◀DT So/Lo▶, ◀PTS So/Lo▶, and Pinnacle Exception golf balls are not found to literally contain this claim element, an equivalent element is present. It is my opinion that the hardness differentials within 2-3 points of 20 degrees JIS-C is insubstantial and would not affect the performance of a golf ball.

As clearly demonstrated in the Acushnet manufacturing guidelines, such a variation is a function of manufacturability. Thus, Acushnet at least inherently recognizes that the performance characteristics would not be adversely affected in any way so as to show an appreciable difference between a core having a surface to center hardness difference of less than 20 degrees compared to those measured by Dr. Caulfield.

Further, results of hardness testing using durometers can be affected by the durometer used in testing and the person doing the testing. Any variance between Dr. Caulfield's testing results and the claimed range is within the "noise" of hardness testing using durometers. (*See* ASTM D-2240 03 at Section 11 and Tables 3-4).

Therefore, a core having the center-surface hardness differential as shown in Table F-3 would have resilience characteristics substantially the same as those golf balls having center-surface hardness differentials of between less than 20 degrees on a JIS-C scale. This function is provided in the same way, as the cores of the accused NXT, DT SoLo and Pinnacle Exception golf balls are made of a polybutadiene rubber material having the overall physical properties and attributes as described in the '834 patent. The use of the same materials provides the same result in that the desired resilience. This is because a difference core distribution hardness between those measured and as set forth in claim 1 will have not appreciable or substantial affect on the

golf ball performance, as is evidenced in Acushnet's manufacturing specifications for the ◀NXT▶, ◀-NXT-▶, DT So/Lo, PTS So/Lo and Pinnacle Exception golf balls.

F. **"a hardness within 5 mm inside the core surface is up to 8 degrees lower than the surface hardness"**

In view of my review at least of the testing data provided by Mr. Caulfield, my review of documents produced by Acushnet, specifically the competitive ball reports and the manufacturing guidelines, my review of deposition testimony, and my understanding of the construction of the accused Acushnet golf balls as a person with more than 30 years experience in the field of golf ball design and development, it is my opinion that each of the accused Acushnet golf balls are golf balls wherein "a hardness within 5 mm inside the core surface is up to 8 degrees lower than the surface hardness."

Dr. Caulfield has performed hardness testing of the accused Acushnet golf balls at the relevant points. A summary of the results of his data are included in Table F-4. I have relied on this data in arriving at my opinions.

Sidestamp	Mean Core Surface Hardness (JIS-C)	Mean Hardness Within 5 mm Inside the Core Surface (JIS-C)	Difference
	A	*B*	*A-B*
◀-NXT-▶	81.8	77.3	5.4
◀DT So/Lo▶ (◀PTS So/Lo▶)	82.1	78.4	5.5
Pinnacle Exception	83.5	79.0	4.9
Exception	79.1	78.9	4.6

Table F-4.

For the ◀NXT▶ and DT So/Lo, I understand that no balls were available to properly test the hardness within 5 mm from the surface of the core. However, Acushnet's manufacturing guidelines clearly show that the cores for the ◀NXT▶ and ◀-NXT-▶ are substantially the

same. For example, the core formulations are identical (compare AB 15341 with AB 15359), the core mixing sequence is identical (compare AB 15342 with AB 15360) and the extrusion and molding conditions are identical (compare AB 15362-63 with AB 15344-45). Further, both cores are red, which would identify them as the same cores.[4] The DT So/Lo and ◀DT So/Lo▶ also have similar cores. I would expect the cores for these two balls to have comparable hardness distributions.

Based on my review of these materials, it is my opinion that each of the accused Acushnet golf balls has a solid core wherein the "a hardness within 5 mm inside the core surface is up to 8 degrees lower than the surface hardness." Indeed, as is shown in Table F-4, the difference between the hardness at the core and the hardness within 5 mm of the surface of the core is less than 8 degrees on a JIS-C scale.

G. **"said cover has a hardness which is higher than the surface hardness of the core by 1 to 15 degrees"**

In view of my review of at least the testing data provided by Mr. Caulfield, my review of documents produced by Acushnet, specifically the competitive ball reports and the manufacturing guidelines, my review of deposition testimony, and my understanding of the construction of the accused Acushnet golf balls as a person with more than 30 years experience in the field of golf ball design and development, it is my opinion that each of the accused

[4] Acushnet 30(b)(6) Depo. (Dalton) of June 21, 2006 at p. 145 ("And even the color of the core was the same, indicating that there was no change, and everything else looks to be pretty much the same."); Dalton Depo. at p. 205 ("In the -- in the industry the color of the core is usually chosen merely as a convenience for manufacturing to help them keep the different kinds of cores that they make separate from one another."); Acushnet 30(b)(6) Depo. of Acushnet (Dalton) of June 25, 2006 at p. 366 ("The cores would have -- have colors, and different colors, so that we could easily tell them apart in the manufacturing operation. So if you see a tote or a big bin full of those cores you -- you know what they are, just by the color, rather than having to measure them or weigh them or anything else.").

Acushnet golf balls are golf balls wherein "said cover has a hardness which is higher than the surface hardness of the core by 1 to 15 degrees" on a JIS-C scale.

Table F-5, below, shows the difference between the mean cover hardness and the mean core surface hardness based on Dr. Caulfield's testing data. I have relied on this data in arriving at my opinions.

Sidestamp	Mean Core Surface Hardness (JIS-C)	Mean Cover Hardness Prepared Plaque (JIS-C)	Difference
	A	*B*	*B-A*
◀NXT▶	83.2	93.3	10.1
◀-NXT-▶	81.8	94.0	12.2
DT So/Lo (PTS SoLo)	85.3	90.3	5.0
◀DT So/Lo▶ (◀PTS So/Lo▶)	82.1	90.0	7.9
Pinnacle Exception	83.5	90.6	7.1
Exception	79.1	91.4	12.3

Table F-5.

I understand that Acushnet does not routinely measure the hardness of the cover of the accused Acushnet golf balls on a JIS-C scale.

Based on my review of these materials, it is my opinion that each of the accused Acushnet golf balls is a golf ball wherein the "cover has a hardness which is higher than the surface hardness of the core by 1 to 15 degrees" on a JIS-C scale. Indeed, as is shown in Table F-5, the difference in hardness between cover and the core surface is between 5.0 and 12.3 degrees on a JIS-C scale.

H. "cover has…a gage of 1.5 to 1.95 mm"

In view of my review of at least the testing data provided by Mr. Caulfield, my review of documents produced by Acushnet, specifically the competitive ball reports and the

manufacturing guidelines (*see* Table F-6), my review of deposition testimony, and my understanding of the construction of the accused Acushnet golf balls as a person with more than 30 years experience in the field of golf ball design and development, it is my opinion that each of the accused Acushnet golf balls are golf balls wherein the "cover has...a gage of 1.5 to 1.95 mm." Based on the Acushnet targeted finished ball diameter and finished core diameters as specified in Acushnet's manufacturing guidelines (see Table F-6), each of the accused Acushnet golf balls has "cover has...a gage of 1.5 to 1.95 mm." Acushnet's competitive ball reports and USGA submissions, among many other documents, also support my opinion. Further, Acushnet admitted that each of the accused Acushnet golf balls have a cover thickness between 1.5 and 1.95 mm.[5]

[5] *See* Acushnet Response to Bridgestone Request for Admission No. 4.

Sidestamp	Acushnet's Specified Cover Thickness (mm)	Support in Manufacturing Guidelines
◀NXT▶	1.69[6]	AB 15355, AB 86350 (1.6830" φ finished ball) AB 15363, AB 86341 (1.550" φ core)
◀-NXT-▶	1.69	AB 15346 (1.6830" φ finished ball) AB 15373 (1.550" φ core)
DT So/Lo (PTS SoLo)	1.69	AB 15290 (1.6830" φ finished ball) AB 15281 (1.550" φ core)
◀DT So/Lo▶ (◀PTS So/Lo▶)	1.68	AB 15303, AB 86385 (1.6825 " φ finished ball) AB 15296, AB 86378 (1.550" φ core)
Pinnacle Exception	1.69	AB 15305, AB 56202 (1.550" φ core) AB 15320, AB 56217 (1.6830" φ finished ball)
Exception	1.50	AB 15322, AB 86387 (1.565" φ core) AB 15337, AB 86402 (1.6830" φ finished ball)

Table F-6.

I. "the number of dimples is 360 to 450"

I have reviewed the manufacturing guidelines for each of the accused Acushnet golf balls. The manufacturing guidelines confirm that each of the accused Acushnet golf balls have 392 dimples. (Table F-7). Acushnet's competitive ball reports and USGA submissions, among

[6] The thickness values listed in this column were calculated by subtracting the finished core diameter from the finished ball diameter, dividing by two and multiplying by 25.4 mm/in.

many other documents, also support my opinion. Further, Acushnet admitted that each of the accused Acushnet golf balls have between 360 and 450 dimples.[7]

Accordingly, it is my opinion that each of the accused Acushnet golf balls has a between 360 and 450 dimples.

Sidestamp	Number of Dimples	Support in Manufacturing Guidelines
◀NXT▶	392	AB 15339
◀-NXT-▶	392	AB 15357, AB 86334
DT So/Lo PTS SoLo	392	AB 15275
◀DT So/Lo▶ ◀PTS So/Lo▶	392	AB 15292, AB 86374
Pinnacle Exception	392	AB 15305, AB 56202
Exception	392	AB 15322, AB 86387

Table F-7.

III. CONCLUSION

Based on the discussions above, it is my opinion that each of the accused Acushnet golf balls manufactured and sold by Acushnet literally infringe claim 1 of the '834 patent. To the extent any element of claim 1 of the '834 patent is found to not be literally present in any such golf balls, that element would be present under the theory of Doctrine of Equivalents.

[7] *See* Acushnet Response to Bridgestone Request for Admission No. 6.

EXHIBIT 5

THIS EXHIBIT HAS BEEN REDACTED IN ITS ENTIRETY

EXHIBIT 6

EX-9

GOLF BALL TESTING PROTOCOLS
Bridgestone vs. Acushnet

Protocol for Core Hardness and Diameter Measurements

This protocol describes the steps to be taken for accurately measuring the hardness at different locations on and inside of the golf ball core. The core hardness test method is in accordance with JIS K6301 – Physical Testing Methods for Testing Vulcanized Rubbers and JIS K6253 – Hardness Testing Methods for Rubber, Vulcanized or Thermoplastic, copies of which are attached as Exhibits C and D, unless otherwise specified.

CORE DIAMETER

BALLS: Pro V1, Pro V1x, Pro V1*, NXT, NXT Tour, DT So/Lo, and Exception

1. Randomly select golf balls of a single type and record all required information as set forth in the GENERAL INSTRUCTIONS.

2. Remove the outer cover and intermediate layers (if present) of the golf ball by using a side cutter. The cutting tool should be advanced into the ball at small increments to ensure that the core is not scarred or scarring is at a minimum.

    a. Prior to cutting remove the cover, refer to photographs of the subject golf ball specimen sectioned in half, or a data chart, to determine the core color, and ball structure. This will notify operator of a possible intermediate layer, and aid in identifying when the operator is close to the core surface.

    b. NOTE: All Pro V1, Pro V1x and Pro V1* golf balls will have a clear intermediate layer before the core. All NXT, NXT Tour, DT So/Lo and Pinnacle Exception golf balls will only have a cover before the core.

3. Manually peel the cover and intermediate layer, if present, of the golf ball to expose the solid core.

    ONCE THE CORE IS EXPOSED ALL OF THE FOLLOWING HARDNESS TESTING FOR THE CORE SURFACE MUST BE COMPLETED WITHIN 24 HOURS.

4. Mark or placard each of the separated components (core, cover and intermediate layer) with the serial number of the golf ball. Place each of the marked or placarded cover and intermediate layer sections in individual packaging marked with the ball serial number.

5. Closely examine the core surface adjacent to the cutting tool path to determine if the core surface was scarred or otherwise nicked by the cutting tool.

a. No testing of the core surface hardness can take place within 20 degrees of the surface scarring.

6. Using a digital height gauge measure and record the outermost diameter of the core at five (5) randomly selected core orientations, not within 30 degrees of each other. Further, the core diameter measurement cannot take place where the core has been nicked or scarred.

   a. Prior to making any measurements, the accuracy of the height gauge must be verified using a certified gauge block.

7. Using the determined average core diameter of each core calculate the standard deviation of the averages.

CORE SURFACE HARDNESS

This test is required to be performed on all NXT, NXT Tour, DT So/Lo, Pinnacle Exception and Pro V1 golf balls. The core hardness test method is in accordance with JIS K6301 – Physical Testing Methods for Testing Vulcanized Rubbers and JIS K6253 – Hardness Testing Methods for Rubber, Vulcanized or Thermoplastic, unless otherwise specified.

BALLS: Pro V1, Pro V1x, Pro V1*, NXT, DT So/Lo, and Exception

8. Verify hardness tester accuracy by performing hardness testing on calibration block.

   a. Hardness results performed on the calibration block must be within the limits specified on the calibration block.

   b. If the machine is not in calibration do not continue.

9. Perform hardness measurements in the JIS C hardness scale at five (5) locations on the surface of the ball. Each of the five points are to be randomly selected and are to be marked to identify the location of the hardness test. The hardness measurement points must not be within 20 degrees of each other, and are not to have any scarring or nicks. Further, at each of the five locations five (5) individual and discrete measurements are to be taken.

   a. The JIS C testing should be in accordance with the JIS K6301 standards. It is recognized that the core is a round surface, however, this deviation from the hardness standard is acceptable.

   b. Confirm the highest point of the core is the point that is being tested. The presser foot of the indenter must not contact the core's surface until the indenter is completely immerged into the material.

c. The locations of the hardness measurement points are to be selected taking into account the protocol set forth below regarding testing at 5 mm within the surface of the core, so as to minimize the number of measurement points which are permanently lost when that protocol is performed.

10. Record each individual measurement in a data table and calculate an average for each of the five locations tested. Using these five averages calculate a core surface hardness average. Record the averages in the data table.

11. Using the determined average hardness at the surface of each core calculate the standard deviation of the averages.

HARDNESS AT 5MM WITHIN THE SURFACE OF THE CORE

This test is only required to be performed on NXT, DT So/Lo and Pinnacle Exception golf balls, and is not to be performed on any Pro V1 golf balls. The core hardness test method is in accordance with JIS K6301 – Physical Testing Methods for Testing Vulcanized Rubbers and JIS K6253 – Hardness Testing Methods for Rubber, Vulcanized or Thermoplastic, unless otherwise specified.

BALLS: NXT, DT So/Lo, and Exception

12. Remove cover in accordance with Steps 2 and 3 above.

13. Select a portion of the core to be tested, preferably not resulting in the removal or discarding any core surface hardness testing locations.

14. Machine gripping surfaces or slots in the core opposite from the selected portion of the core to be tested, as described in other testing protocols so as to allow for the secure gripping of the core.

15. Use a band saw to cut off the selected portion of the core (selected in Step 12) at a point at least 8 mm from the surface of the core, so as to create a specimen which is at least 8 mm in thickness at its deepest point.

    a. Store the remaining core section in a sealed, evacuated container/package so as to limit exposure to the atmosphere, and place with the remaining ball components from the golf ball tested.

16. Secure the specimen created in Step 14 in a Bridgeport, or comparable, end-mill device in such a way to ensure the specimen is secure while minimizing squeezing and distorting the specimen. The specimen is to be secured such that the surface cut by the band saw is facing the end-mill tooling (i.e. curved surface away), and the surface is level.

GOLF BALL TESTING PROTOCOLS
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ONCE THE FOLLOWING MACHINING PROCESS BEGINS ALL OF THE FOLLOWING HARDNESS PROTOCOL FOR 5 MM WITHIN THE CORE SURFACE MUST BE COMPLETED WITHIN 24 HOURS.

17. Using the Bridgeport, or comparable, end-mill machine, machine off the cut surface of the specimen in multiple passes. The depth of each pass is to minimal such that the specimen is not destroyed during the process or dislodged from the end-mill gripping vise.

    a. A cutting head and cutting speed must be used to minimize burrs and heat generation during the machining process.

    b. At least 10 seconds should elapse between each machining pass to allow for heat dissipation.

18. The amount of material to be removed is to result with a test specimen which is 5 mm thick at its thickest point.

    a. As the 5 mm limit is approached the depth of each pass is to be reduced to a depth of no more than 0.05 mm. This will ensure minimal damage and scarring to the surface of the specimen.

    b. At least 10 seconds should elapse between each machining pass to allow for heat dissipation.

    c. The tolerance of the thickness of the specimen, at its thickest point is 5 mm +/- 0.2 mm. If the amount of removed material is within this tolerance, the test may proceed.

19. Inspect the machined surface of the test specimen. If the surface is smooth testing may proceed. If the test surface is not smooth it is to be hand buffed to provide a smooth surface.

20. Record the height of the test specimen.

    a. The tolerance of the 5 mm thickness is +/- 0.2 mm. If the amount of removed material is within this tolerance, the test may proceed.

    b. If the test specimen is not within this tolerance, but is within an additional +/- 0.2 mm, the specimen may be tested but its non-compliance with the above tolerance is to be recorded.

    c. Locate and identify the center of the machined surface.

21. Verify hardness tester accuracy by performing hardness testing on calibration block.

a. Hardness results performed on the calibration block must be within the limits specified on the calibration block.

b. If the machine is not in calibration do not continue, and calibrate machine accordingly.

22. Perform hardness test in accordance with JIS C standard at the center of the machined surfaces. Five (5) separate and discrete tests are to be done at the center of each of the machined surfaces.

23. Record each of the (five) 5 measurements, for each side, and determine and record an average of the (five) 5 measurements, for each side. Each data point is to be recorded.

24. Determine and record a core hardness average by calculating an average based on the averages from each respective milled surfaces.

25. Store the tested specimen in a sealed, evacuated container/package so as to limit exposure to the atmosphere, and place with the remaining ball components from the golf ball tested.

26. Using the determined average hardness at 5 mm within the surface of each core calculate the standard deviation of the averages.

CORE CENTER HARDNESS:

This test is required to be performed on all NXT, DT So/Lo, Pinnacle Exception and Pro V1 golf balls. The core hardness test method is in accordance with JIS K6301 – Physical Testing Methods for Testing Vulcanized Rubbers and JIS K6253 – Hardness Testing Methods for Rubber, Vulcanized or Thermoplastic, unless otherwise specified.

BALLS: Pro V1, Pro V1x, Pro V1*, NXT, DT So/Lo, and Exception

27. Repeat Steps 1 through 6 above on randomly selected golf balls; OR

a. For NXT, NXT Tour, DT So/Lo and Pinnacle Exception golf balls, it is possible to use the twelve (12) cores from Steps 1-11.[1]

ONCE THE FOLLOWING MACHINING PROCESS BEGINS ALL OF THE FOLLOWING HARDNESS PROTOCOL FOR CORE CENTER HARDNESS MUST BE COMPLETED WITHIN 24 HOURS.

[1] For Pro V1 model golf balls the protocol for Core Hardness Distribution may be conducted first, followed by the protocol for measuring core center hardness.

28. Using the Bridgeport, or comparable, end-mill machine, machine off the section of the core selected for removal to a depth within 0.3 to 0.4 mm above the calculated center of the core.

    a. The entire depth of removed material should not be machined off in one pass, but a plurality of passes not exceeding a depth of 1 mm is to be used.

    b. A cutting head and cutting speed must be used to minimize burrs and heat generation during the machining process.

    c. At least 10 seconds should elapse between each machining pass to allow for heat dissipation.

29. To reach the final depth of the core center, the machined surface is to be buffed with no GREATER than 220 grit sandpaper, or comparable abrasive, to provide smooth surface free of machining marks and/or grooves. The buffing step must be done at a slow speed to minimize heat generation at the surface of the core, and a depth of no more than 0.05 mm for any one pass.

    a. At least 10 seconds should elapse between each machining pass to allow for heat dissipation.

30. Locate and identify the center of the machined surface.

31. Record the new ball diameter.

32. The tolerance of the center of the core is +/- 0.2 mm. If the amount of removed material is within this tolerance, the test may proceed.

33. Verify hardness tester accuracy by performing hardness testing on calibration block.

    a. Hardness results performed on the calibration block must be within the limits specified on the calibration block.

    b. If the machine is not in calibration do not continue, and calibrate machine accordingly.

34. Perform hardness test in accordance with JIS C standard at the center of the machined surface. Five (5) separate and discrete tests are to be done at the center of the machined surface.

35. Record each of the (five) 5 measurements and determine and record an average of the (five) 5 measurements.

36. Store the remaining core section in a sealed, evacuated container/package so as to limit exposure to the atmosphere, and place with the remaining ball components from the golf ball tested.

    a. The cores of the Pro V1 model golf balls may be used in the following protocol for CORE HARDNESS DISTRIBUTION. If this is done the CORE HARDNESS DISTRIBUTION test must be done within 24 hours of exposure of the center of the core.

37. Using the determined average hardness at the center of the core calculate the standard deviation of the averages.

CORE HARDNESS GRADIENT:

This test is required to be performed on all Pro V1 and Pro V1x[2] model golf balls and is not to be performed on any of the NXT, NXT Tour, DT So/Lo, and Pinnacle Exception golf balls. The core hardness test method is in accordance with JIS K6301 – Physical Testing Methods for Testing Vulcanized Rubbers and JIS K6253 – Hardness Testing Methods for Rubber, Vulcanized or Thermoplastic, unless otherwise specified.

BALLS: Pro V1 and Pro V1x

PRO V1

38. For **Pro V1** model golf balls, using the calculated diameter of the core from Steps 1 through 6, calculate the core radius and divide the radius into three (3) equidistant sections, which identifies two (2) evenly spaced points between the core center and the core surface along a single radial line to the surface.

    a. Record the core radius and measurement for the equidistant sections.

    b. Each of the evenly spaced points represent measurement depths for the core hardness distribution. The outermost point is the first measurement depth and the innermost point (not the center) is the second measurement point.

39. The core surface hardness is to be measured and recorded in accordance with the Core Surface Hardness protocol, set forth above.

40. Select a portion of the core to be removed, and mark the surface of the core.

41. Mount the core on a platen surface of a Bridgeport, or comparable, end-mill machine, using a mounting structure which minimizes squeeze of the core, while maintaining the core in a fixed position. The area marked in Step 40 shall be facing vertically and represent the highest point on the core's circumference.

[2] The protocol for the Pro V1x is different from that of the Pro V1, as set forth herein.

GOLF BALL TESTING PROTOCOLS
Bridgestone vs. Acushnet

ONCE THE FOLLOWING MACHINING PROCESS BEGINS ALL OF THE FOLLOWING HARDNESS PROTOCOL MUST BE COMPLETED WITHIN 24 HOURS.

42. Using the Bridgeport, or comparable, end-mill machine, machine off the section of the core selected for removal to a depth of 0.3 to 0.4 mm above the first measurement depth of the core.

    a. The entire depth should not be machined off in one pass, but a plurality of passes in which a set depth of material is removed in each pass. As the desired cut depth approaches each pass should not exceed a depth of more than 1 mm to ensure accuracy.

    b. A cutting head and cutting speed must be used to minimize burrs and heat generation during the machining process.

    c. At least 10 seconds should elapse between each machining pass to allow for heat dissipation.

43. To reach the final depth of the first measurement depth, the machined surface is to be buffed with no GREATER than 220 grit sandpaper, or comparable abrasive, to provide smooth surface free of machining marks and/or grooves. The buffing step must be done at a slow speed to minimize heat generation at the surface of the core, and a depth of no more than 0.05 mm for any one pass.

    a. At least 10 seconds should elapse between each machining pass to allow for heat dissipation.

44. Locate and identify the center of the first measurement surface and mark the center

45. Record the new ball diameter.

    a. The tolerance of the first measurement surface is +/- 0.2 mm. If the amount of material removed is within this tolerance, the test may proceed.

46. At a position 180 degrees from the first measurement surface, create the second measurement surface (from the results in Step 38b) repeating Steps 42 through 44 above.

47. Locate and identify the center of the second measurement surface and mark the center.

48. Record the new ball diameter.

    a. The tolerance of the second measurement surface is +/- 0.2 mm. If the amount of material removed is within this tolerance, the test may proceed.

49. Verify hardness tester accuracy by performing hardness testing on calibration block.

    a. Hardness results performed on the calibration block must be within the limits specified on the calibration block.

    b. If the machine is not in calibration do not continue, and calibrate machine accordingly.

50. Perform hardness test in accordance with JIS C standard at the center of the two machined measurement surfaces. Five (5) separate and discrete tests are to be done at the center of the machined surface.

51. Record each of the five (5) measurements and determine and record an average of the (five) 5 measurements.

52. If the core center hardness is to be determined, proceed to the Core Center Hardness protocol and complete the core center hardness test.

53. Using the determined average hardness on each of the measurement surfaces, calculate the standard deviation of the averages for each of the respective measurement surfaces.

PRO V1x

54. For **Pro V1x** model golf balls, using the calculated diameter of the core from Steps 1 through 6, calculate the core radius.

    a. Record the core radius.

    b. For the purposes of measuring the hardness distribution of the Pro V1x golf balls, the depths of measurement are laid out below:

        i. First measurement depth is 3.5 mm from the core surface.

        ii. Second measurement depth is at the surface of the center portion of the core (i.e. gray color portion in model ◄ Pro V1x-332 ► and blue color portion in model ◄●Pro V1x 332●►).[3]

        iii. Third measurement depth is at 6.4 mm below the second measurement depth.

[3] The target diameter of the core is 1.55 inches whereas the target diameter of the inner portion of the core is 1.0 inches. Accordingly, the third measurement depth is approximately 7.0 mm below the surface of the core.

iv. Fourth measurement depth is at the center of the inner portion of the core, determined based on the calculated radius of the core.

55. The core surface hardness is to be measured and recorded in accordance with the Core Surface Hardness protocol, set forth above.

56. Select a portion of the core to be removed, and mark the surface of the core.

57. Mount the core on a platen surface of a Bridgeport, or comparable, end-mill machine, using a mounting structure which minimizes squeeze of the core, while maintaining the core in a fixed position. The area marked in Step 56 shall be facing vertically and represent the highest point on the core's circumference.

ONCE THE FOLLOWING MACHINING PROCESS BEGINS ALL OF THE FOLLOWING HARDNESS PROTOCOL MUST BE COMPLETED WITHIN 24 HOURS.

58. Using the Bridgeport, or comparable, end-mill machine, machine off the section of the core selected for removal to a depth of 0.3 to 0.4 mm above the first measurement depth of the core.

    a. The entire depth should not be machined off in one pass, but a plurality of passes in which a set depth of material is removed in each pass. As the desired cut depth approaches each pass should not exceed a depth of more than 1 mm to ensure accuracy.

    b. A cutting head and cutting speed must be used to minimize burrs and heat generation during the machining process.

    c. At least 10 seconds should elapse between each machining pass to allow for heat dissipation.

59. To reach the final depth of the first measurement depth, the machined surface is to be buffed with no GREATER than 220 grit sandpaper, or comparable abrasive, to provide smooth surface free of machining marks and/or grooves. The buffing step must be done at a slow speed to minimize heat generation at the surface of the core, and a depth of no more than 0.05 mm for any one pass.

    a. At least 10 seconds should elapse between each machining pass to allow for heat dissipation.

60. Locate and identify the center of the first measurement surface and mark the center.

61. Record the new ball diameter.

a. The tolerance of the first measurement surface is +/- 0.2 mm. If the amount of material removed is within this tolerance, the test may proceed.

62. At a position 180 degrees from the first measurement surface, create the second measurement surface repeating Steps 58 through 59 above.

63. Locate and identify the center of the second measurement surface and mark the center.

64. Record the new ball diameter.

a. The tolerance of the second measurement surface is +/- 0.1 mm. If the amount of material removed is within this tolerance, the test may proceed.

65. Verify hardness tester accuracy by performing hardness testing on calibration block.

a. Hardness results performed on the calibration block must be within the limits specified on the calibration block.

b. If the machine is not in calibration do not continue, and calibrate machine accordingly.

66. Perform hardness test in accordance with JIS C standard at the center of the first two measurement surfaces. Five (5) separate and discrete tests are to be done at the center of the machined surface.

67. Record each of the (five) 5 measurements and determine and record an average of the (five) 5 measurements.

68. Machine the second measurement surface to the third measurement surface following the same procedures set forth above in Steps 58 - 61.

69. Perform hardness test in accordance with JIS C standard at the center of the machined surface of the third measurement surface. Five (5) separate and discrete tests are to be done at the center of the machined surface.

70. Record each of the (five) 5 measurements and determine and record an average of the (five) 5 measurements.

71. For the fourth measurement surface (core center hardness), proceed to the Core Center Hardness protocol and complete the core center hardness test.

72. Using the determined average hardness on each of the measurement surfaces, calculate the standard deviation of the averages for each of the respective measurement surfaces.

EX-18

TABLE VI
CORE HARDNESS RESULTS (JIS C)
Pro V1, Pro V1 Star, NXT, DT So/Lo and Pinnacle Exception

Ball Model		Surface (JIS C)	Within 5mm of Core Surface (JIS C)	Difference - Surface and 5mm (JIS C)	Core Center (JIS C)
P2	Average	82.8			63.3
	Standard Deviation	1.06			1.41
	Minimum	81.4			61.4
	Maximum	84.2			65.2
PS	Average	86.8			
	Standard Deviation	1.13			
	Minimum	85.0			
	Maximum	90.2			
N2	Average	81.8	77.3	5.4	60.4
	Standard Deviation	1.10	0.85	0.88	1.55
	Minimum	79.4	74.6	4.0	56.4
	Maximum	84.8	79.0	7.2	64.0
N1	Average	83.2			61.7
	Standard Deviation	0.74			1.29
	Minimum	82.0			59.6
	Maximum	85.0			64.2
D2	Average	82.1	78.4	5.5	61.8
	Standard Deviation	3.39	1.49	1.16	1.38
	Minimum	71.4	74.0	2.0	58.8
	Maximum	86.6	79.4	6.8	65.0
D1	Average	85.3			63.1
	Standard Deviation	0.33			1.67
	Minimum	84.6			59.4
	Maximum	86.0			66.4
E2	Average	79.1	78.9	4.6	61.0
	Standard Deviation	3.21	1.77	1.35	1.29
	Minimum	72.8	74.2	1.2	59.0
	Maximum	83.0	80.2	6.2	64.2
E1	Average	83.9	79.0	5.0	61.9
	Standard Deviation	1.01	0.56	0.64	1.41
	Minimum	82.0	78.0	3.2	58.6
	Maximum	85.6	80.0	6.0	65.0

EXHIBIT 7

563061

Paul Hastings

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Rence,

Please find attached additional information from Dr. Caulfield.

Regards,

Brandon

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Ball Manufacturer: **Titleist** Tester: klj Room Temperature: 70

Model: **DT/SOLO** Date: 10/25/06 Room Humidity: 58

Time Start: 2:05 PM Time Finish: 4:05 PM

	SIDE A							
	Core 5mm Hardness (JIS - C)							
Ball ID	1	2	3	4	5	Average	Group Average	Group Standard Deviation
D1.UU.05	74	74	74	73	73	73.6	73.7	1.089
D1.UU.01	76	75	75	75	75	75.2		
D1.UU.10	73	72	73	72	73	72.6		
D1.UU.07	73	74	73	73	73	73.2		
D1.SS.03	74	74	74	74	73	73.8	74.3	0.954
D1.SS.11	75	75	75	74	75	74.8		
D1.SS.17	75	74	74	75	74	74.4		
D1.SS.08	76	75	75	75	74	75		
D1.SS.04	74	74	74	75	74	74.2		
D1.SS.24	73	73	73	72	72	72.6		
D1.SS.15	76	75	75	75	76	75.4		
D1.SS.21	74	74	74	74	73	73.8		
D1.WW.02	75	75	75	75	74	74.8	73.7	0.949
D1.WW.06	73	73	73	73	73	73		
D1.WW.12	74	75	75	73	74	74.2		
D1.WW.19	75	75	74	73	74	74.2		
D1.WW.13	73	73	73	73	73	73		
D1.WW.09	74	74	74	73	73	73.6		
D1.WW.23	73	72	72	72	72	72.2		
D1.WW.16	74	74	74	75	74	74.2		

SIDE B							
Core 5mm Hardness (JIS - C)							
1	2	3	4	5	Average	Group Average	Group Standard Deviation
76	75	75	75	75	75.2	74.6	0.821
75	75	75	75	74	74.8		
76	74	75	74	75	74.8		
74	74	74	73	73	73.6		
75	75	74	74	74	74.4	74.6	0.705
76	76	76	75	75	75.6		
75	75	74	74	74	74.4		
75	75	75	75	74	74.8		
76	75	75	75	75	75.2		
75	74	74	74	73	74		
75	74	74	75	74	74.4		
75	74	74	74	74	74.2		
75	74	74	75	75	74.6	74.0	0.815
74	74	74	75	75	74.4		
74	73	73	73	74	73.4		
75	75	74	74	74	74.4		
74	73	73	72	72	72.8		
74	74	74	74	75	74.2		
74	74	73	73	73	73.4		
75	74	74	74	75	74.4		

Ball Manufacturer: **Titleist** Tester: PBO Room Temperature: 70

Model: **DT/SOLO** Date: 10/9/2006 Room Humidity: 59

Time Start: 2:30 Time Finish: 4:00 PM

	SIDE A							
	Core 5mm Hardness (JIS - C)							
Ball ID	1	2	3	4	5	Average	Group Average	Group Standard Deviation
D2.CC.16	73	72	72	71	71	71.8	72.3	0.785
D2.CC.24	73	73	72	72	72	72.4		
D2.CC.02	73	73	73	73	72	72.8		
D2.CC.09	73	73	72	72	72	72.4		
D2.CC.21	74	73	73	72	72	72.8		
D2.CC.10	72	72	71	71	71	71.4		
D2.BB.07	74	73	73	73	73	73.2	72.2	0.817
D2.BB.17	72	71	71	71	71	71.2		
D2.BB.04	73	73	72	72	72	72.4		
D2.BB.13	72	72	72	71	71	71.6		
D2.BB.23	72	72	72	72	72	72		
D2.BB.10	73	73	73	73	73	73		
D2.RR.03	74	74	74	74	73	73.8	72.6	1.006
D2.RR.18	73	73	73	72	72	72.6		
D2.RR.19	73	73	73	73	73	73		
D2.RR.14	72	71	71	71	71	71.2		
D2.RR.05	74	73	73	73	73	73.2		
D2.RR.11	72	72	72	71	71	71.6		
D2.AA.15	74	74	74	74	73	73.8	72.9	0.923
D2.AA.22	73	73	73	72	72	72.6		
D2.AA.20	73	73	73	73	73	73		
D2.AA.08	72	72	72	71	71	71.6		
D2.AA.04	75	74	74	73	73	73.8		
D2.AA.01	73	73	73	72	72	72.6		

SIDE B							
Core 5mm Hardness (JIS - C)							
1	2	3	4	5	Average	Group Average	Group Standard Deviation
74	73	73	73	73	73.2	72.9	0.629
74	73	73	73	72	73		
74	73	73	73	73	73.2		
73	72	72	72	72	72.2		
74	73	73	73	72	73		
73	73	73	72	72	72.6		
74	74	73	73	73	73.4	72.3	0.907
72	72	72	71	71	71.6		
74	73	73	73	73	73.2		
72	72	72	71	71	71.6		
72	72	72	71	71	71.6		
73	72	72	72	72	72.2		
74	74	74	74	73	73.8	73.1	0.845
74	74	74	74	74	74		
74	74	74	73	73	73.6		
72	72	72	72	72	72		
73	73	73	73	72	72.8		
73	73	72	72	72	72.4		
74	74	73	73	73	73.4	73.6	0.774
74	74	73	73	73	73.4		
74	74	73	73	73	73.4		
75	74	74	74	74	74.2		
75	75	74	74	74	74.4		
73	73	73	72	72	72.6		

Ball Manufacturer: **Titleist** Tester: _____ Room Temperature: _____

Model: **DT/SOLO** Date: _____ Room Humidity: _____

Time Start: _____ Time Finish: _____

	SIDE A							
	Core 5mm Hardness (JIS - C)							
Ball ID	1	2	3	4	5	Average	Group Average	Group Standard Deviation
D2.GG.01	71	71	70	70	71	70.6	70.6	0.9
D2.GG.04	70	70	70	70	70	70		
D2.GG.13	72	72	72	72	72	72		
D2.GG.16	71	71	70	71	70	70.6		
D2.GG.31	70	69	70	70	70	69.8		
D2.GG.34	72	70	70	71	70	70.6		
D2.GG.39	70	70	70	70	70	70		
D2.GG.41	72	72	72	72	72	72		
D2.GG.48	70	70	70	70	70	70		
D2.FF.05	71	71	71	71	71	71	71.9	1.0
D2.FF.10	74	74	74	73	74	73.8		
D2.FF.14	73	73	73	72	72	72.6		
D2.FF.19	72	72	71	70	71	71.2		
D2.FF.24	72	72	72	72	71	71.8		
D2.FF.28	72	72	71	71	71	71.4		
D2.FF.32	72	71	71	71	71	71.2		
D2.FF.41	72	72	72	72	72	72		
D2.FF.43	N/A					#DIV/0!		

D2.HH.01	70	70	70	70	70	70	70.3	0.9
D2.HH.08	70	69	69	70	69	69.4		
D2.HH.18	71	71	70	70	71	70.6		
D2.HH.20	70	70	70	69	70	69.8		
D2.HH.26	71	70	71	71	70	70.6		
D2.HH.29	72	71	72	71	72	71.6		
D2.HH.35	72	71	72	72	71	71.6		
D2.HH.40	70	70	70.4	70	70	70.08		
D2.HH.45	70	69	69	70	69	69.4		
D2.OO.02	72	72	72	73	73	72.4	71.6	0.9
D2.OO.04	72	71	71	71	71	71.2		
D2.OO.12	72	71	71	72	72	71.6		
D2.OO.13	73	72	72	72	73	72.4		
D2.OO.19	71	71	71	71	70	70.8		
D2.OO.23	72	72	71	71	71	71.4		
D2.OO.26	72	72	72	71	71	71.6		
D2.OO.30	73	73	72	73	72	72.6		
D2.OO.36	70	70	70	70	70	70		

SIDE B							
Core 5mm Hardness (JIS - C)							
1	2	3	4	5	Average	Group Average	Group Standard Deviation
71	71	71	71	71	71	70.6	0.5
72	71	71	71	71	71.2		
71	71	71	71	71	71		
71	71	71	71	71	71		
70	70	70	71	70	70.2		
70	70	70	70	70	70		
71	71	71	71	70	70.8		
71	70	70	70	70	70.2		
71	70	71	70	70	70.4		
73	72	72	72	72	72.2	72.2	0.5
73	72	72	72	72	72.2		
72	72	72	72	72	72		
72	72	72	73	72	72.2		
73	73	73	73	73	73		
72	72	72	72	71	71.8		
72	72	71	72	72	71.8		
73	72	72	72	72	72.2		
N/A					#DIV/0!		

71	71	71	70	70	70.6	71.2	0.9
72	71	71	72	71	71.4		
72	71	71	71	71	71.2		
71	72	71	71	71	71.2		
72	72	72	71	71	71.6		
72	72	73	73	73	72.6		
72	72	72	72	72	72		
71	71	71	71	71	71		
70	70	70	69	69	69.6		
72	72	72	72	72	72	71.9	0.9
72	73	72	72	72	72.2		
73	73	72	73	73	72.8		
73	73	73	72	72	72.6		
72	72	71	71	71	71.4		
72	72	71	72	71	71.6		
72	73	73	73	72	72.6		
73	72	72	72	72	72.2		
70	70	70	70	70	70		

Ball Manufacturer: **Pinnacle** Tester: PBO Room Temperature: 71

Model: **Exception** Date: 10/31/06 Room Humidity: 56

Time Start: 11:00 Time Finish: 11:30 AM

	SIDE A							
	Core 5mm Hardness (JIS - C)							
Ball ID	1	2	3	4	5	Average	Group Average	Group Standard Deviation
E1.KK.02	73	73	73	73	73	73	73.0	0.459
E1.KK.04	73	73	73	72	72	72.6		
E1.KK.07	73	73	73	73	73	73		
E1.KK.11	74	74	73	73	73	73.4		
E1.SS.01	73	73	73	73	73	73	72.8	0.410
E1.SS.06	73	73	73	73	73	73		
E1.SS.09	73	73	73	73	72	72.8		
E1.SS.10	73	73	72	72	72	72.4		
E1.WW.03	73	73	73	73	72	72.8	72.1	0.545
E1.WW.05	72	72	72	72	72	72		
E1.WW.08	72	72	72	72	72	72		
E1.WW.12	73	73	72	72	72	72.4		
E1.WW.13	73	72	72	72	72	72.2		
E1.WW.17	72	72	72	72	72	72		
E1.WW.20	72	71	71	71	71	71.2		
E1.WW.24	73	72	72	72	72	72.2		

SIDE B							
Core 5mm Hardness (JIS - C)							
1	2	3	4	5	Average	Group Average	Group Standard Deviation
74	74	74	74	73	73.8	73.7	0.801
73	73	73	72	72	72.6		
75	74	74	74	74	74.2		
75	74	74	74	74	74.2		
73	72	72	72	72	72.2	73.0	0.605
73	73	73	73	73	73		
74	74	73	73	73	73.4		
74	73	73	73	73	73.2		
74	73	73	73	73	73.2	72.4	0.594
73	73	72	72	72	72.4		
73	73	72	72	72	72.4		
73	72	72	72	72	72.2		
73	73	72	72	72	72.4		
73	73	73	72	72	72.6		
72	72	72	72	71	71.8		
73	73	72	72	72	72.4		

Ball Manufacturer: **Pinnacle** Tester: PBO Room Temperature: 70

Model: **Exception** Date: 10/9/2006 Room Humidity: 59

Time Start: 2:30 Time Finish: 4:00 PM

	SIDE A							
	Core 5mm Hardness (JIS - C)							
Ball ID	1	2	3	4	5	Average	Group Average	Group Standard Deviation
E1.AB.01	74	73	73	73	72	73	73.1	0.848
E1.AB.05	74	73	73	73	73	73.2		
E1.AB.09	75	74	74	74	74	74.2		
E1.AB.16	74	74	73	73	73	73.4		
E1.AB.20	73	73	72	72	72	72.4		
E1.AB.24	73	73	73	72	72	72.6		
E1.AB.27	73	73	73	72	72	72.6		
E1.AB.31	75	74	74	74	74	74.2		
E1.AB.35	73	72	72	72	72	72.2		
E1.CC.02	73	73	72	72	72	72.4	72.8	0.670
E1.CC.06	74	73	73	73	73	73.2		
E1.CC.07	73	73	72	72	72	72.4		
E1.CC.17	73	73	73	73	73	73		
E1.CC.21	74	74	74	74	73	73.8		
E1.CC.22	74	73	73	73	73	73.2		
E1.CC.25	73	73	73	72	72	72.6		
E1.CC.32	73	72	72	72	72	72.2		
E1.CC.36	73	72	72	72	72	72.2		

E1.EE.03	72	72	71	71	71	71.4	73.1	1.027	
E1.EE.04	74	74	73	73	73	73.4			
E1.EE.08	74	74	74	73	73	73.6			
E1.EE.18	75	75	74	74	74	74.4			
E1.EE.19	73	73	73	72	72	72.6			
E1.EE.23	74	74	73	73	73	73.4			
E1.EE.26	73	73	72	72	72	72.4			
E1.EE.33	73	73	73	72	72	72.6			
E1.EE.34	75	74	74	74	74	74.2			
E1.JJ.04	75	75	75	75	74	74.8	73.6	0.867	
E1.JJ.08	73	73	72	72	72	72.4			
E1.JJ.12	74	74	73	73	73	73.4			
E1.JJ.15	75	74	74	74	74	74.2			
E1.JJ.19	73	73	73	73	73	73			
E1.JJ.23	75	75	74	74	74	74.4			
E1.JJ.25	73	73	73	73	73	73			
E1.JJ.28	74	74	74	74	74	74			
E1.JJ.33	73	73	73	73	72	72.8			

SIDE B							
Core 5mm Hardness (JIS - C)							
1	2	3	4	5	Average	Group Average	Group Standard Deviation
73	73	73	73	72	72.8	73.5	0.695
74	74	73	73	73	73.4		
74	74	74	73	73	73.6		
75	74	74	74	74	74.2		
74	73	73	73	73	73.2		
73	73	73	73	72	72.8		
74	74	73	73	73	73.4		
75	74	74	74	74	74.2		
75	74	74	73	73	73.8		
74	73	73	73	73	73.2	73.4	0.751
73	73	73	72	72	72.6		
73	73	72	72	72	72.4		
74	74	74	74	74	74		
75	74	74	74	74	74.2		
75	74	74	74	74	74.2		
74	73	73	73	73	73.2		
74	74	73	73	73	73.4		
74	74	73	73	73	73.4		

74	73	73	73	73	73.2	73.5	0.757
74	73	73	73	73	73.2		
75	74	74	74	74	74.2		
75	74	74	74	74	74.2		
73	72	72	72	72	72.2		
74	74	74	73	73	73.6		
74	73	73	73	73	73.2		
74	73	73	73	73	73.2		
75	74	74	74	74	74.2		
75	75	75	74	74	74.6	73.9	0.668
74	74	73	73	73	73.4		
74	74	74	74	73	73.8		
75	75	75	74	74	74.6		
74	74	74	73	73	73.6		
74	74	74	73	73	73.6		
75	75	74	74	74	74.4		
74	74	74	74	74	74		
74	73	73	73	73	73.2		

Ball Manufacturer: **Pinnacle** Tester: klj Room Temperature: 70

Model: **EXCEPTION** Date: _____ Room Humidity: 59

Time Start: 11:30 AM Time Finish: _____

Calibration Check (Start): 51, 51, 51
Calibration Check (Finish): 51, 51, 51

	Core 5mm Hardness (JIS - C)							
Ball ID	1	2	3	4	5	Average	Group Average	Group Standard Deviation
E2.FF.01	71	71	71	71	71	71	71.0	1.0
E2.FF.05	71	71	70	71	70	70.6		
E2.FF.12	70	70	70	70	69	69.8		
E2.FF.17	72	72	72	70	70	71.2		
E2.FF.19	71	71	71	71	71	71		
E2.FF.27	73	73	73	72	73	72.8		
E2.FF.36	71	71	71	70	70	70.6		
E2.FF.40	71	71	70	70	70	70.4		
E2.FF.44	72	72	72	72	71	72		
E2.GG.03	71	71	71	70	71	70.8	70.8	0.8
E2.GG.10	71	71	71	70	71	70.8		
E2.GG.15	71	71	71	71	70	70.8		
E2.GG.17	71	71	71	71	71	71		
E2.GG.22	72	72	71	71	71	71.4		
E2.GG.26	72	71	71	71	71	71.2		
E2.GG.30	72	72	71	71	71	71.4		
E2.GG.43	70	69	69	69	69	69.2		
E2.GG.46	71	70	71	70	71	70.6		

E2.00.07	70	70	70	70	70	70	69.8	1.1
E2.00.11	71	71	71	70	71	70.8		
E2.00.14	69	68	68	69	69	68.6		
E2.00.23	69	69	69	69	70	69.2		
E2.00.28	72	72	71	72	72	71.8		
E2.00.31	69	69	69	69	69	69		
E2.00.37	69	69	69	68	69	68.8		
E2.00.41	71	71	71	70	71	70.8		
E2.00.45	69	69	69	69	69	69		
E2.HH.02						#DIV/0!	69.8	1.1
E2.HH.08	70	71	70	70	70	70.2		
E2.HH.18	71	71	71	71	71	71		
E2.HH.24	71	71	71	71	71	71		
E2.HH.25	69	70	69	70	70	69.6		
E2.HH.33	68	68	68	68	68	68		
E2.HH.35	69	69	68	69	69	68.8		
E2.HH.42	70	71	69	69	70	69.8		
E2.HH.48	71	70	70	70	70	70.2		

Core 5mm Hardness (JIS - C)								
1	2	3	4	5	Average	Group Average	Group Standard Deviation	
72	72	72	71	71	71.75	71.0	0.8	
70	70	70	70	70	70			
72	71	71	71	71	71.2			
73	72	72	70	72	71.8			
71	71	71	71	71	71			
72	71	72	72	71	71.6			
71	71	70	71	70	70.6			
71	71	71	70	70	70.6			
71	70	70	71	70	70.4			
71	71	71	71	71	71	70.7	0.7	CORES LIGHT BLUE IN COLOR
71	71	71	71	71	71			
71	71	71	71	71	71			
70	70	69	69	69	69.4			
71	71	71	71	71	71			
71.4	71.6	71.2	71.2	71	71.28			
71	71	71	70	71	70.8			
70	70	70	70	70	70			
72	71	71	71	71	71.2			

69	70	70	69	69	69.4	69.8	1.2
72	71	72	71	71	71.4		
70	69	70	70	69	69.6		
69	68	69	69	69	68.8		
72	72	71	72	72	71.8		
70	70	69	69	69	69.4		
69	69	69	68	68	68.6		
70	70	70	70	70	70		
70	69	69	68	69	69		
					#DIV/0!	70.1	0.9
71	71	70	71	71	70.8		
70	70	71	70	70	70.2		
71	70	71	71	72	71		
70	70	70	70	70	70		
69	69	69	68	69	68.8		
70	69	68	69	69	69		
71	70	70	71	70	70.4		
71	71	70	70	70	70.4		

Ball Damaged During Machining - TESTING STOPPED

Ball Manufacturer: **Titleist** Tester: KLJ Room Temperature: 70

Model: **NXT** Date: 10/25/06 Room Humidity: 58

Time Start: 11:10 AM Time Finish: 1:55:00 PM

	SIDE A							
	Core 5mm Hardness (JIS - C)							
Ball ID	1	2	3	4	5	Average	Group Average	Group Standard Deviation
N1.TT.15	72	72	72	71	71	71.6	72.0	0.785
N1.TT.09	72	72	72	72	72	72		
N1.TT.16	73	73	73	73	72	72.8		
N1.TT.06	73	73	73	72	72	72.6		
N1.TT.02	71	72	71	71	71	71.2		
N1.TT.11	71	71	71	71	71	71		
N1.TT.20	73	73	73	72	72	72.6		
N1.SS.23	73	73	72	73	72	72.6	72.3	0.960
N1.SS.21	73	73	73	72	72	72.6		
N1.SS.14	74	73	73	73	73	73.2		
N1.SS.12	73	72	72	72	73	72.4		
N1.SS.07	71	71	71	71	70	70.8		
N1.SS.03	72	72	72	72	72	72		
N1.SS.18	74	73	74	73	73	73.4		
N1.SS.05	72	71	71	71	71	71.2		
N1.UU.10	72	72	71	72	71	71.6	71.9	0.759
N1.UU.08	71	71	71	71	71	71		
N1.UU.17	72	72	72	71	72	71.8		
N1.UU.01	73	73	73	72	72	72.6		
N1.UU.04	72	73	71	72	71	71.8		
N1.UU.13	73	73	73	72	72	72.6		

SIDE B							
Core 5mm Hardness (JIS - C)							
1	2	3	4	5	Average	Group Average	Group Standard Deviation
71	71	71	71	71	71	72.1	1.056
72	72	72	72	71	71.8		
74	73	73	73	73	73.2		
72	72	72	71	73	72		
73	73	72	72	73	72.6		
71	71	70	70	71	70.6		
74	73	73	73	73	73.2		
73	73	73	72	72	72.6	73.0	0.906
73	73	73	73	73	73		
75	75	74	75	74	74.6		
73	72	73	72	72	72.4		
73	73	73	72	72	72.6		
73	72	72	73	72	72.4		
74	74	74	74	74	74		
73	72	72	73	72	72.4		
72	72	72	71	71	71.6	71.5	1.137
70	70	70	70	70	70		
73	73	73	73	73	73		
73	73	73	72	72	72.6		
71	71	70	71	70	70.6		
72	72	71	71	71	71.4		

Ball Manufacturer: **Titleist** Tester: PBO Room Temperature: 71

Model: **NXT** Date: 10/9/2006 Room Humidity: 58

Time Start: 11:05 AM Time Finish: 1:55

	Core 5mm Hardness (JIS - C)							
Ball ID	1	2	3	4	5	Average	Group Average	Group Standard Deviation
N2.JJ.48	72	72	71	71	71	71.4	71.4	0.855
N2.JJ.28	71	70	70	70	70	70.2		
N2.JJ.38	72	72	72	72	71	71.8		
N2.JJ.33	73	72	73	72	72	72.4		
N2.JJ.25	72	72	72	71	72	71.8		
N2.JJ.42	71	71	71	70	71	70.8		
N2.CC.12	70	70	70	69	69	69.6	70.4	0.894
N2.CC.18	72	72	72	72	72	72		
N2.CC.09	70	70	70	70	70	70		
N2.CC.15	70	70	70	70	70	70		
N2.CC.24	71	71	71	71	71	71		
N2.CC.03	70	70	70	70	69	69.8		
N2.AB.23	69	69	69	68	68	68.6	70.3	2.368
N2.AB.20	70	69	69	69	60	67.4		
N2.AB.05	71	71	71	70	71	70.8		
N2.AB.17	72	72	72	72	71	71.8		
N2.AB.08	72	72	72	72	71	71.8		
N2.AB.02	72	72	71	72	71	71.6		
N2.BB.04	71	71	70	70	70	70.4	71.3	0.794
N2.BB.13	72	71	71	71	70	71		
N2.BB.19	72	71	71	71	71	71.2		
N2.BB.22	73	73	72	72	72	72.4		
N2.BB.07	72	72	71	71	71	71.4		
N2.BB.10	72	71	71	72	71	71.4		

Core 5mm Hardness (JIS - C)							
1	2	3	4	5	Average	Group Average	Group Standard Deviation
72	71	71	71	71	71.2	71.6	0.621
72	72	71	71	71	71.4		
72	72	71	72	71	71.6		
72	72	72	72	72	72		
72	72	70	71	71	71.2		
73	72	72	72	72	72.2		
70	70	70	70	70	70	71.0	1.129
72	72	72	73	72	72.2		
71	71	71	71	70	70.8		
71	72	71	71	71	71.2		
72	72	73	73	72	72.4		
70	70	70	69	69	69.6		
70	70	70	69	69	69.6	70.9	0.885
71	70	70	70	70	70.2		
71	72	71	71	71	71.2		
72	72	71	71	71	71.4		
72	72	72	71	71	71.6		
72	72	71	71	71	71.4		
71	71	71	71	71	71	71.9	0.753
72	71	72	71	71	71.4		
73	73	72	72	72	72.4		
73	73	72	72	72	72.4		
73	72	72	72		72.25		
73	73	72	71	72	72.2		

Ball Manufacturer: **Titleist** Tester: PBO Room Temperature: 71

Model: **NXT** Date: 9/7/2006 Room Humidity: 56

Time Start: 8:55 AM Time Finish: 1:55

	Core 5mm Hardness (JIS - C)							
Ball ID	1	2	3	4	5	Average	Group Average	Group Standard Deviation
N2.FF.01	71	71	70	70	70	70.4	70.5	1.0
N2.FF.09	72	72	71	71	70	71.2		
N2.FF.11	73	73	72	72	72	72.4		
N2.FF.16	70	70	70	70	69	69.8		
N2.FF.19	71	70	70	69	69	69.8		
N2.FF.27	70	70	69	69	69	69.4		
N2.FF.32	71	71	70	70	70	70.4		
N2.FF.41	71	71	70	70	70	70.4		
N2.FF.45	71	71	70	70	70	70.4		
N2.GG.04	70	70	70	69	69	69.6	70.3	1.0
N2.GG.07	71	71	71	71	71	71		
N2.GG.14	70	70	70	69	69	69.6		
N2.GG.21	73	72	72	72	72	72.2		
N2.GG.22	70	70	70	70	70	70		
N2.GG.25	70	70	69	69	69	69.4		
N2.GG.30	70	70	70	69	69	69.6		
N2.GG.40	71	71	71	70	70	70.6		
N2.GG.48	71	71	70	70	70	70.4		

N2.HH.02	70	70	70	70	70	70	69.9	1.0
N2.HH.05	71	70	69	69	69	69.6		
N2.HH.13	70	70	70	69	69	69.6		
N2.HH.24	69	69	69	68	68	68.6		
N2.HH.26	70	70	70	69	69	69.6		
N2.HH.28	70	70	70	69	69	69.6		
N2.HH.34	72	71	71	71	71	71.2		
N2.HH.42	72	72	71	71	71	71.5		
N2.HH.43	71	70	70	69	69	69.8		
N2.OO.03	70	70	69	69	69	69.4	69.6	1.0
N2.OO.08	71	70	70	70	69	70		
N2.OO.10	69	69	68	68	68	68.4		
N2.OO.15	72	71	71	70	70	70.8		
N2.OO.20	69	68	68	68	68	68.2		
N2.OO.23	71	70	70	70	69	70		
N2.OO.29	70	70	69	69	69	69.4		
N2.OO.31	71	71	71	70	70	70.6		
N2.OO.35	71	70	70	69	69	69.8		

Core 5mm Hardness (JIS - C)							
1	2	3	4	5	Average	Group Average	
72	71	71	70	71	71	71.4	0.6
73	72	72	72	71	72		
72	72	71	71	71	71.4		
72	71	71	71	71	71.2		
72	71	71	71	71	71.2		
72	72	72	71	71	71.6		
72	72	71	71	71	71.4		
72	72	71	71	71	71.4		
72	72	71	71	71	71.4		
72	72	71	71	71	71.4	71.3	0.8
72	71	71	71	71	71.2		
72	72	71	71	71	71.4		
73	73	72	72	72	72.4		
72	72	71	71	71	71.4		
71	71	70	70	70	70.4		
71	71	70	70	70	70.4		
73	72	72	72	71	72		
72	72	71	71	71	71.4		

71	71	70	71	71	70.8	70.7	0.8
71	70	70	70	69	70		
71	71	70	70	70	70.4		
72	71	71	71	70	71		
71	71	70	70	70	70.4		
72	72	72	72	71	71.8		
72	72	71	71	71	71.4		
71	70	70	70	70	70.25		
71	71	70	70	70	70.4		
71	70	70	70	70	70.2	70.7	0.9
72	71	70	70	70	70.6		
71	70	70	70	69	70		
73	72	72	72	71	72		
70	70	69	69	69	69.4		
71	71	71	71	70	70.8		
72	72	71	71	71	71.4		
71	71	70	70	70	70.4		
72	72	71	71	71	71.4		

EXHIBIT 8

THIS EXHIBIT HAS BEEN REDACTED IN ITS ENTIRETY

EXHIBIT 9

THIS EXHIBIT HAS BEEN REDACTED IN ITS ENTIRETY

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

CERTIFICATE OF SERVICE

I, David E. Moore, hereby certify that on April 20, 2007, the attached document was hand delivered to the following persons and was electronically filed with the Clerk of the Court using CM/ECF which will send notification to the registered attorney(s) of record that the document has been filed and is available for viewing and downloading:

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I hereby certify that on April 20, 2007, I have Electronically Mailed the documents to the following:

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